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# PENICILLIN IN THE TREATMENT OF INTRA-ABDOMINAL INFECTION

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THE literature concerning the use of penicillin in the treatment of intra-abdominal suppuration is relatively scant to date. Fauley and co-workers[1] employed penicillin in large doses in the treatment of experimentally induced peritonitis in dogs. These workers found that animals with an appendiceal peritonitis protected with large doses of penicillin begun at the time of operation, showed no mortality as compared to 92.6 per cent mortality among the non-treated controls. They also found that a 12 hour delay in commencing penicillin was associated with the death of 21 per cent of the animals. Harper and Blain[2] found that penicillin prolonged the lives of dogs with a closed-loop type of intestinal obstruction. They used the drug systemically as well as by injection into the obstructed jejunal loops and felt that the penicillin inhibition of the bacteria lowered the eventual fatal toxemia.

Penicillin injected intramuscularly or intravenously appears in the peritoneal fluid in titres approximating those found in the blood.[3] Conversely it has also been shown that intraperitoneally injected penicillin gives high levels in the blood stream.[4]

The earlier reports in the literature[5,6] usually based on small to medium doses of penicillin were not hopeful regarding the value of this agent in treating peritoneal suppuration. Individual case reports[7,8,9] more recently claim success for penicillin given in various dosages, parenterally as well as locally, in the treatment of peritonitis. Imes[10] found penicillin and the sulfonamides of about equal

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value in the treatment and prevention of early peritonitis complicating war wounds of the bowel in the Italian campaign. Craig[11] reported 7 cases of peritonitis associated with ruptured appendix that received 20,000 units of penicillin every 2 hours for from 5 to 7 days. All cases had smooth postoperative courses with rapid decline of fever and symptoms. This author found a mixture of gram-positive and gram-negative organisms in the peritoneal exudate and suggested that a combination of sulfonamides and penicillin should be effective in combating the two types of bacteria. Crile[12] advocated the using of massive doses of penicillin in the treatment of pyogenic peritonitis produced by bowel organisms, and presented 30 cases without any deaths. He described numerous instances of spontaneous resolution of inflammatory intraperitoneal masses without drainage while under penicillin treatment. Wound infections were present in 5 cases. Peritoneal cultures repeatedly revealed E. coli and other penicillin-resistant organisms, in addition to gram-positive cocci. This worker attributed his excellent results to the fact that although a portion of the penicillin might be neutralized by penicillinase[13] of the gram-negative group, the remainder was effective against the gram-positive and anerobic pathogenes. Also he felt that with the gram-positive organisms controlled, the peritoneum was well able to handle the essentially saprophytic bacilli. The same author[14] has since added considerably to his series of successful cases and has shown by in vitro tests that a given strain of staphylococcus when mixed with a strain of colon bacillus requires 8 times the amount of penicillin for inhibition as does the same strain of staphylococcus alone.

Many of the gram-negative bacilli formerly considered totally insusceptible to penicillin are now known to be sensitive in varying degrees, although far less so than the gram-positive bacilli.[15,16,17] Hobby[18] found high concentrations of penicillin to be effective in vitro against some strains of E. typhosa, S. dysenteria Flexner, S. paratyphi, S. panama, Proteus vulgaris, B. abortus, K. pneumonia, S. marcescens, P. aeruginosa, and E. coli. Steiner[19] reported varying degrees of susceptibility in vitro in certain strains of Proteus vulgaris, E. typhosa, S. hirschfeldii, S. enteritidis, S. paratyphi, S. Schottmuleri, E. coli, and A. aerogenes. These two observers report only one strain each of E. coli, A. aerogenes and P. aeruginosa to be completely resistant to penicillin. In view of these findings, Steiner suggests a possible therapeutic application of penicillin to gram-negative bacillary infections.

## Present Studies

From May, 1944, to May, 1946, in two Army General Hospitals

the authors have treated 18 cases of intra-abdominal suppuration with local and parenteral penicillin. We are excluding from this series 4 cases of peritonitis resulting from continued leakage from the large bowel from various causes, since it is well known that such uncontrolled fecal leakage inevitably produces a peritonitis overwhelming to any therapy. The 18 cases here presented (Table I) include 10 abscesses of appendiceal origin and abscesses following cecostomy for obstructing carcinoma; a right subphrenic abscess of uncertain cause; 2 cases of gangrenous appendicitis ruptured during removal, and 4 cases of generalized peritonitis, 3 following ruptured appendices and one following a septic abortion. There were no deaths in this series. We have learned that 2 patients were subsequently operated upon in civilian hospitals for acute intestinal obstruction.

No set pattern of treatment was followed in this series. Ileus, when present, was treated by constant suction through a Miller-Abbot or Levine tube. Plasma proteins were maintained at 6.5 grams per cent or better. By means of transfusions, the red count was prevented from going below 4,250,000. Adequate parenteral vitamin therapy was also supplied as required. In earlier cases average penicillin doses (25,000 to 40,000 units every 3 hours) were used, but in the more recent ones we have come to use 60,000 to 100,000 units every 3 hours. Figures recorded under "treatment" in Table I represent peak dosages and these were reduced as the acute phase of the disease subsided. At operation in the majority of the cases 100,000 units of penicillin in 50 c.c. of normal saline solution of 5 grams of sulfanilamide crystals were placed intraperitoneally. A convenient method of assuring retention of penicillin in the peritoneal cavity is to place a ureteral catheter to the desired location, close the wound about the catheter, inject the penicillin and then withdraw the catheter.

Intraperitoneal drainage was employed only twice (Cases 3 and 8, Table I), and in the former case for the control of retroperitoneal bleeding.

Operative wounds were closed in layers with fine non-absorbable sutures and without drainage to peritoneum. Nine wounds healed per primum and 4 developed a mild infection not compromising the integrity of the wound.

Cases 1 and 2, Table I, developed a flare-up of unidentified fever, coincident with the reduction of penicillin dosage and subsiding when the dosage was again increased. In Case 2 the small wound abscess recorded in the Table was a small superficial abscess not appearing until after the patient returned from furlough, and thus

TABLE I

PENICILLIN TREATMENT OF INTRA-ABDOMINAL INFECTIONS

ABSCESS, APPENDICEAL

| Case No. | Description | Bacteriology at Operation | Treatment | Days Fever | Days Treatment | Results |
|---|---|---|---|---|---|---|
| 1. | 4 months' duration. Severe reactivation 14 days old. Preoperative temperature 104° F. | No growth (Anerobes suspected nevertheless). | Penicillin 60,000 U. q. 3 h. I. M. Intraperitoneally 100,000 U. plus 5 Gm. sulfanilamide. Appendectomy. Closure without drainage. | 31 | 28 | Temporary fecal fistula. Severe febrile relapse after initial subsidence. |
| 2. | 5 days' duration. Pelvic abscess. Preoperative temperature 101.8° F. | A. fecalis | Penicillin 80,000 U. q. 3 h. I. M. Intraperitoneally 200,000 U. plus 5 Gm. sulfanilamide. Appendectomy. Closure without drainage. | 11 | 14 | Small superficial wound infection. |
| 3. | 30 hour history. Huge retroperitoneal abscess. Preoperative temperature 101.6° F. | Strep. viridens | Penicillin 100,000 U. q. 3 h. I. M. Intraperitoneally 100,000 U. plus 5 Gm. sulfanilamide crystals. Appendectomy. Wound packed through sleeve of glove. | 9 | 11 | Temporary fecal fistula. Main wound healed per primum. |
| 4. | 7 days' duration with localized peritonitis. Preoperative temperature 102.0° F. | No growth | Penicillin 100,000 U. q. 3 h. I. M. Intraperitoneally 5 Gm. sulfanilamide crystals. Interval appendectomy. Closure without drainage. | 7 | 18 | Abscess and local peritonitis smoothly resolved without operation |
| 5. | 6 days' duration. Partial intestinal obstruction. Preoperative temperature 101.3° F. | Diphtheroids E. coli | Penicillin 100,000 U. q. 3 h. I. M. Intraperitoneally 100,000 U. plus 5 Gm. sulfanilamide crystals. Appendectomy and lysis of adhesions. No drainage. | 18 | 20 | Bout of fever and abdominal pain late in course and subsiding spontaneously. |

TABLE I (*Continued*)

| Case No. | Description | Bacteriology at Operation | Treatment | Days Fever | Days Treatment | Results |
|---|---|---|---|---|---|---|
| 6. | 4 months' duration. An associated fecal fistula. Fecalith in abscess. | No growth (Anerobes suspected nevertheless). | Penicillin 100,000 U. q. 3 h. I. M. Intraperitoneally 5 Gm. sulfanilamide. Appendectomy. Closure without drainage. | ? | 23 | Healing complicated by wound infection. |
| 7. | 80 hours' duration. Small early abscess. Preoperative temperature 99.6° F. | Strep. viridens | Penicillin 60,000 U. q. 3 h. I. M. Intraperitoneally 5 Gm. sulfanilamide crystals. Appendectomy. Closure without drainage. | 4 | 5 | Wound healed per primum. |
| 8. | 3 days' duration. Early, with localized peritonitis. Preoperative temperature 99.6° F. | Non-hemolytic strep., E. coli, Diphtheroids. | Penicillin 25,000 U. q. 3 h. I. M. Appendectomy. | 7 | 7 | Wound healed per primum. |
| 9. | 4 days' duration. Associated with miscarriage. Preoperative temperature 103.2° F. | E coli (Anerobes also suspected). | Penicillin 45,000 U. q. 3 h. I. M. Abscess drained without appendectomy. | 8 | 7 | Rapid subsidence. Still slight drainage at discharge. |
| 10. | 4 days' duration. Early with foul watery pus. | Strep. viridens, Micrococci, anerobic spore-former. | Penicillin 100,000 U. q. 3 h. I. M. Locally 100,000 U. plus 5 Gm. sulfanilamide. Appendectomy. Closure without drainage. | 18 | 23 | Deep wound infection and pelvic abscess with spontaneous resolution. |

TABLE I (*Continued*)

ABSCESS, NON-APPENDICEAL

| Case No. | Description | Bacteriology at Operation | Treatment | Days Fever | Days Treatment | Results |
|---|---|---|---|---|---|---|
| 11. | RLQ and pelvic abscess following cecostomy spillage (Cancer of colon). | No culture since abscess resolved without surgery. | Penicillin 60,000 U. q. 3 h. I. M. No surgery till obstructive resection of cancer of splenic flexure 29 days later. | 11 | 9 | Resolution without drainage. Partial intestinal obstruction subsided with intubation. |
| 12. | Right subphrenic abscess of uncertain origin. Pre-treatment temperature 102.0° F. | Strep. non-hemolytic. Hemolytic staphylococcus aureus, coagulase positive. | Penicillin 10,000 U. q. 4 h. I. M. Previously sulfadiazine 6 Gm. a day for 7 days without benefit. Incision and drainage at start of sulfadiazine therapy. | 7 | 14 | It was felt that penicillin had saved the life of this seriously ill patient. |
| | | GANGRENOUS APPENDICITIS WITH RUPTURE DURING REMOVAL | | | | |
| 13. | 60 hours' duration. Preoperative temperature 103.6° F. | B. pyocyaneus, Diphtheroids | Penicillin 40,000 U. q. 3 h. I. M. Intraperitoneally 100,000 U. plus 5 Gm. sulfanilamide crystals. Appendectomy. Closure without drainage. | Record lost | 10 | Small serum collection in wound with later per primum healing. |
| 14. | 20 hours' duration. Preoperative temperature 103.2° F. | E. coli. Diphtheroids | Penicillin 80,000 U. q. 3 h. I. M. Intraperitoneally 100,000 U. plus 5 Gm. sulfanilamide crystals. Appendectomy. Closure without drainage. | 19 | 18 | Localized peritonitis and early pelvic abscess resolution. |

TABLE I (*Continued*)

GENERALIZED PERITONITIS FROM RUPTURED APPENDIX

| Case No. | Description | Bacteriology at Operation | Treatment | Days Fever | Days Treatment | Results |
|---|---|---|---|---|---|---|
| 15. | 50 hours' duration. Complicated by pneumonia. Preoperative temperature 100° F. | Alpha hemolytic strep. | Penicillin 25,000 U. q. 3 h. Previous sulfadiazine (blood level 3.8 mg. %) of no avail. Appendectomy. Later drainage of pelvic abscess. | 9 | 15 | Developed pelvic abscess requiring drainage. |
| 16. | 2 days' duration. Preoperative temperature 103.0° F. | E. coli<br>B. pyocyaneus | Penicillin 40,000 U. q. 3 h. I. M. Appendectomy. | 10 | 14 | Smooth course. No wound infection. |
| 17. | 6 days' duration. Very ill. Temperature swing 101.0° to 104.0° F. | Aspiration culture<br>A. aerogenes, gram positive cocci, type? | Penicillin 60,000 U. q. 3 h. I. M. Appendectomy 3 mos. later confirmed diagnosis. | 33 | 42 | Slow progress. RLQ and rectal mass resolved without surgery. |
| | | GENERALIZED PERITONITIS FROM SEPTIC ABORTION | | | | |
| 18. | 14 days' duration. Complicated by bilateral pneumonia, severe. | Strep. fecalis<br>E. coli<br>A. aerogenes<br>B. proteus | Penicillin 25,000 U. q. 3 h. I. M. Previous sulfadiazine (blood level 8.0 to 20.0 mg%) of no avail. Lower midline drainage. | 29 | 37 | Desperately ill patient unimproved by 4 days sulfadiazine. Recovered. |

could scarcely have caused his earlier fever. Three cases (9, 15 and 18, Table I) whose penicillin therapy ranged from 25,000 to 45,000 units every 3 hours developed abscesses requiring surgical drainage. The other cases developed intraperitoneal inflammatory masses (Cases 4, 11, 14 and 17) which resolved spontaneously under injections of penicillin varying from 60,000 to 100,000 units every 3 hours.

It should be noted that Cases 15, 18 and 20 were desperately ill patients, in whom a preliminary course of sulfadiazine varying from 4 to 7 days proved inadequate and it was felt at the time that penicillin had prevented a fatal outcome. It will be observed in Table I that in a number of cases 5 grams of sulfanilamide crystals were applied locally to the operative wound. Also in Case 10, 8 grams of sodium sulfadiazine were given intravenously during the first postoperative days. How much share these sulfonamides had in the final outcome cannot be stated, but it is felt that they were of minor effect compared to the penicillin.

The cultures as recorded in Table I have not been in our opinion very satisfactory nor indicative, since on more than one occasion anerobic organisms were obviously present clinically although they could not be recovered.

As already observed there seemed to be a definite tendency for resolution of intra-abdominal inflammatory masses when treated with very large doses of penicillin. If this finding is borne out in later experiences, or in wider applications, it will constitute an additional valuable attribute of penicillin therapy. This resolution of intraperitoneal suppuration under penicillin influence is an interesting deviation from the behavior of cavity pus elsewhere when treated with the agent, as in these later instances the drug is notoriously ineffective.

## Summary and Conclusion

The absence of any deaths in this small number of cases is of little statistical importance. However, when taken together with the larger series of Crile and Craig it appears of some significance. It is our clinical impression that penicillin is of definite therapeutic value, probably more than are the sulfonamides. We agree with Crile that only with large doses of penicillin does enough of the agent escape destruction by penicillinase to exert a bacteriostatic or bacteriocidal effect on the pathogenes responsible for peritonitis, i.e., the gram positive cocci and anerobes.

In a given case of peritonitis of appendiceal origin we would recommend as an adjunct to surgery 80,000 to 100,000 units of peni-

cillin every 3 hours intramuscularly or even a larger dose in desperately ill patients for the first few days, with the reduction of dosage according to the progress of the disease. Also from the uneventful convalescence of several patients in whom an early appendiceal abscess was inadvertently opened while under adequate penicillin therapy, we believe the long delay ordinarily advocated between the subsidence of the acute infection and interval appendectomy can be considerably shortened.

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# APPENDECTOMY

## A Technic for Total Excision

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KRONLEIN in 1884 reported the first appendectomy by simple ligation and excision. Shortly after this Treeves advised covering the stump with Lembert sutures and Senn suggested the use of a purse-string with inversion of the stump. Deaver reported excision of the appendix with open suture of the cecal wall as did Haggard.

These methods have been championed or condemned by various surgeons through the years since, and a complete review of the literature on this subject was reported by Ochsner and Lilly in 1937 with their method of appendectomy. This method, briefly, is as follows:

The mesoappendix is ligated in sections; the appendix is triply clamped at the base and a purse-string suture inserted in such a way as to catch any intramural branch of the appendiceal artery with a loop. The appendix is removed with the thermocautery between the two distal clamps. The second clamp is removed and the remaining cuff of tissue grasped with a toothless tissue forceps, the last clamp removed and the stump buried by means of the purse-string suture. The area is then well peritonized and the cecum dropped back into the abdomen.

This operation is used by many, and it seems to have advantages over other reported methods in that it does away with the danger of cecal abscess, intestinal obstruction from a stump that is left free in the peritoneal cavity, and hemorrhage from an intramural branch of the appendiceal artery.

In searching for a method which had more of the advantages and fewer of the disadvantages, it occurred to me that none of the usual methods utilized the commonly accepted practices in modern intestinal surgery; i.e., closure of the intestine using crushing clamps with a narrow blade by means of a suture applied over the clamp. This is the method in general use for closing the duodenal stump and in end-to-end anastamosis of the intestine. The same is true of the blind ends of the intestine when a lateral anastamosis is to be made, the bowel being closed without really being opened to the general abdominal cavity. After considering various methods it was finally decided to use a crushing clamp and apply a Cushing suture over

the clamp completely excising the stump, utilizing the usual "closed" method of intestinal suture.

The method as it is now used requires no more time than the two inversion methods and is as easy to perform, giving absolute control of the appendix in cases where it is difficult to deliver because of the fact that the cecum is grasped instead of the mesoappendix or an adherent gangrenous appendix. The base of the appendix is identified and the cecum clamped one centimeter or more below the junction of the cecum and appendix. This clamp is left in place and the mesoappendix clamped and ligated in sections and dissected free. The appendix is again clamped and removed with a knife or cautery between the clamps. A single suture is inserted just below the tip of the clamp to include any intramural branch of the appendiceal artery and a 000 gastrointestinal suture is begun at the base of the clamp as a Cushing over the clamp suture biting into the muscular layer and continuing well beyond the limit of tissue caught by the tip of the clamp. Each suture in the first line is so placed as to hold in its grasp as much of the seromuscular layer, parallel with the clamp, as possible. This gives perfect inversion and lessens the danger of breaking apart the agglutinated area. The clamp is then removed as its tip is depressed and the suture held taut. While the suture is still held taut it is reversed and continued by locked stitches to its origin, locked and tied to the end held by the assistant. These sutures in the second row bite rather deeply in the muscular layer and are locked to prevent hemorrhage and aid in perfect closure. When the suture line is short it is not necessary to lock this layer if the stitches include the muscularis. If the stump of the mesoappendix is long enough it may be fastened over the suture line. Silk or cotton sutures have been used instead of catgut but, since this must be a continuous suture, catgut is preferred.

It is usually possible to place the crushing clamp on the cecum proximal to the area of induration, allowing easier handling for the completion of Crile's so-called "Robin operation." This tends to prevent soiling of hands and wound surfaces, shortens the operative time and prevents trauma to the cecum from undue traction and the rough handling which seems many times unavoidable. There has been found no single instance of gross spill from the cecum or evidence postoperatively of peritoneal soiling in using this method routinely for the past 8 years.

Ease of performance, complete excision of all the diseased tissue, serosa-to-serosa suture of the cecum by a closed technic and freedom from danger of hemorrhage are the chief advantages of this method.

One other advantage is the total removal of the appendix and as

much cecal head as necessary in those fulminating cases which if removed by any of the conventional methods may develop a fecal fistula or if nature is not kind the dreaded "blowout" and a spreading peritonitis.

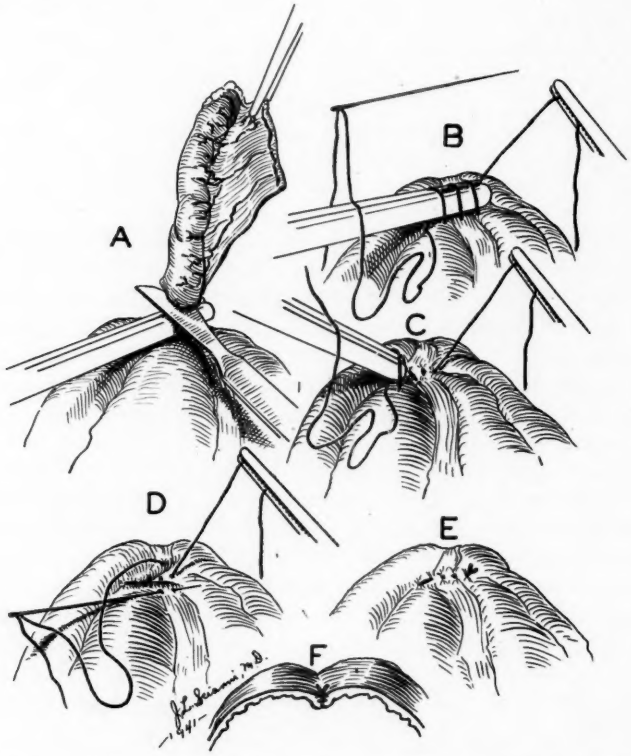


Fig. 1. a. The appendix is being removed. The clamp shown is usually placed slightly lower on the cecum. The upper clamp is omitted purposely as is the separate ligature for the intramural branch of the appendiceal artery. b. Completed suture line, first row of sutures. c. Clamp is being removed as suture is held taut. d. Suture reversed and second row of sutures being inserted. e. Completed suture line. f. Cross section of completed suture line.

In reviewing the literature in an effort to find a report of this method, I have been unable to find any method resembling it except Deaver's method of complete excision and open suture, which was abandoned because of the danger of contamination, and a reference by Dr. Fredrick Bancroft to the method used by Dr. John Clark of Philadelphia years ago in cases where the cecum was so indurated that a fecal fistula was feared. He applied a clamp across the cecum

below the indurated area and excised the appendix and any necessary part of the cecal head. This method was reserved for use in those cases in which there was too much induration to use any of the conventional methods, and Bancroft states that he finds it very satisfactory in these cases. I have been unable to find where anyone has reported the routine use of the above method for complete removal of the appendix and closure of the cecal wound by a suture over the clamp. I have found it necessary in only one case to include several millimeters of the cecal head, but this is rare as the induration usually stops abruptly at the junction of the appendix and cecum since most of these fulminating appendices are obstructive in origin and the obstruction is distal to this point.

Dr. Louie Felger reports using a similar technic for non-ligation inversion, but does not advocate excision of the base of the appendix. His method is very similar to Ochsner's except that he sutures the cecum over the unligated stump in a straight suture line.

## SUMMARY

A method is presented for routine removal of the appendix by total excision, utilizing a commonly used method of intestinal suture. I believe this method to be safe and as easily and quickly performed as the other methods. It has been used routinely for the past 8 years without complications.

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# THE SURGICAL ASPECTS OF DIVERTICULA OF THE DUODENUM

## With the Report of an Additional Surgical Case

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DIVERTICULA of the duodenum are by no means uncommon, though their exact frequency is difficult to determine. According to McQuay[1] the roentgenologic frequency is about 1 per cent and the postmortem frequency somewhat higher. Baldwin (cited by MacLean[2]) found 14 diverticula in the course of 105 autopsies and estimated the roentgenologic frequency at 1.5 per cent. Apparently they are much more frequent when they are specifically sought: Grant (also cited by MacLean[2]) found 6 instances in 37 autopsies over a 3 year period after he had begun to inject the duodenum in all cadavers with paraffin. Probably the chief reason that diverticula of the duodenum are thought of as uncommon is that they do not usually give rise to symptoms and that only a small number of surgically treated cases are on record in the literature.

As Morton[3] pointed out in his comprehensive review of the subject in 1940, diverticula associated with duodenal ulceration, to which they were secondary, had been diagnosed and treated long before Forsell and Key, in 1915, first deliberately attacked a diverticulum of the duodenum for the primary reason that it was itself causing symptoms. Until 1940, according to Morton, only 49 surgical cases were on record in the literature, and the experience at the University of Rochester Hospitals, from which his report was made, might be cited as typical. In 33 recognized instances of duodenal diverticulum, operation was undertaken only twice, and in one of those cases, because the width of the opening made it seem unlikely that stasis would occur, as well as for other reasons, the pouch was not disturbed.

Although several instances of surgically treated diverticula have been placed on record since Morton's report was made, the number is still small enough to warrant the report of an additional case.

### REPORT OF CASE

A white woman, 58 years of age, was referred to the Vicksburg Clinic Nov. 14, 1946, by Dr. W. N. Jenkins, with a diagnosis of cholelithiasis. The diag-

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nosis seemed fully justified by the patient's history. Her chief complaint was intermittent attacks of flatulence and abdominal distention, which were accompanied by severe lancinating pain in the epigastrium and by nausea and vomiting. The pain radiated to the point of the right scapula. It was relieved when vomiting occurred, either spontaneously or when induced by the patient herself, in an endeavor to secure relief. The attacks, which had been occurring for the past 10 years, had always been of the same pattern, but were becoming increasingly severe. They were usually precipitated by the ingestion of fatty foods, meat and green vegetables. They were not associated with either fever or jaundice, and rather severe frontal headaches, which occurred frequently, apparently coincided with them only accidentally. Stools had always been normal in color, and occasional melena could be explained by the passage of hard, constipated feces. Constipation had been present only since the onset of the attacks described.

For the last several years the patient had been aware of a mass protruding from the vagina and had had almost constant dull, aching pain in the pelvis and lower back, not related in any way to the intermittent severe attacks referable to the gastrointestinal tract. She had borne 15 children, apparently uneventfully, and had passed through an uneventful menopause 13 years previously. The genitourinary history was negative except for incision and drainage of an abscess of the perirenal space in 1936, which had been followed by complete recovery, and nocturia (twice nightly). With these exceptions the patient had been well and had worked hard all her life; in fact, except for the attacks which had brought her to the hospital, she regarded her health as excellent.

Her father had died of peptic ulcer at the age of 79 years and her mother, who was 75 years of age, was thought to have carcinoma of the stomach.

Physical examination revealed a well developed, moderately obese woman, apparently in good health. The blood pressure was 220/110. There was marked pulsation in the suprasternal notch and the heart was apparently enlarged toward the left; no definite cardiac murmur could be made out. The upper abdomen was somewhat distended and there was considerable tenderness in the right upper quadrant. In the right lower quadrant was a well healed surgical scar. Pelvic examination revealed a third degree relaxation of the perineum and a third degree prolapse of the uterus.

Urinalysis and blood serology were negative and the blood count (total and differential) was within normal limits. Electrocardiography revealed no organic disease. Roentgenologic examination of the chest showed the lung markings to be exaggerated, especially in the hilum. The left apical pleura was thickened and the intercostal spaces were widened. The heart did not seem to be enlarged in proportion to the size of the chest. Cholecystography (oral) revealed an apparently normally-functioning gallbladder, with no evidence of stones. Fluoroscopic and roentgenologic examination of the gastrointestinal tract with a barium meal revealed a large diverticulum of the second portion of the duodenum, which was still filled with barium at the end of 48 hours. Two smaller circular areas in the third and fourth portions of the duodenum were regarded as possible additional diverticula. Examination of the large bowel with a barium enema revealed no abnormality except incompetency of the ileocecal valve.

On the basis of the findings in the roentgenologic examination of the gastrointestinal tract and the negative outcome of the examination of the gallbladder,

the tentative diagnosis of cholelithiasis was changed to diverticula of the duodenum. The uterine prolapse was obviously not related to the digestive symptoms, and the patient's cardiovascular disease was not regarded as contraindicating surgical relief of the symptoms referable to the diverticulum.

Operation was carried out December 1, through a high right rectus incision, under cyclopropane anesthesia (W.H.P.). It revealed the following positive findings: On the anteromesial aspect of the second portion of the duodenum was a diverticulum 4 cm. in diameter, the body of which was superficially imbedded in pancreatic tissue. The gallbladder was grossly diseased and contained 2 stones. The common bile duct was enormously dilated.

The diverticulum was dissected free of its pancreatic covering by blunt dissection with moist cotton dissectors. After the sac had been mobilized, the neck was secured with intestinal clippers and was severed flush with the wall of the duodenum. The opening in the duodenal wall was closed by means of a layer of inverting interrupted sutures of chromic No. 0 catgut, supplemented by a second row of interrupted sutures of fine black silk in the serosa. The omentum was fastened over the suture line. Cholecystectomy was then performed, gelfoam being used to control oozing from the gallbladder bed. The common bile duct was opened and a large Bakes dilator was passed without difficulty through the sphincter and into the duodenum. A T tube was placed in the common bile duct and a soft Penrose drain was placed near the gallbladder bed and into the foramen of Winslow. The T tube was brought out through the incision and the Penrose drain through a stab wound in the abdominal wall.

The patient was in good condition throughout the operation and her postoperative course was remarkably smooth. The usual postoperative regimen was instituted, including transfusion, infusions of glucose in physiologic salt solution and distilled water, duodenal suction, and oxygen by nasal catheter. For the first 3 or 4 days there was profuse drainage of bile from the Penrose drain and moderate drainage through the T tube. Some excoriation of the skin of the abdomen about the exit of the Penrose drain was controlled by the use of tincture of benzoin and vaseline gauze. The Penrose drain was removed on the tenth postoperative day; drainage persisted for 3 or 4 days afterward. The T tube was clamped off for increasingly long intervals after the 18th day and was removed on the 21st day, after a retrograde cholangiogram made by the injection of diatrast through the tube. The common duct was found to be somewhat dilated but there was no dilatation of the bile radicles or the hepatic duct and no evidence of stone or obstruction, the opaque medium passing freely into the duodenum. When the patient was discharged the following day there was still slight drainage from the point of exit of the T tube.

She has been seen at intervals in the 8½ months since operation and each time has reported complete relief of all symptoms.

The pathologist described the diverticulum as a thin-walled, sac-like structure with smooth and glistening walls and with a capacity of about 4 c.c. The gallbladder was slightly enlarged and thick-walled. The lumen contained two faceted concretions, each measuring 1 cm. in diameter. The histologic diagnosis was duodenal diverticulum and chronic cholecystitis with cholelithiasis.

## Comment

Diverticula of the duodenum usually occur, or, more correctly,

are usually recognized, in individuals of the fifth and sixth decades of life. They may appear in any portion of the duodenum, but the majority are located in the second portion, in a retroperitoneal position, on the concave aspect. Their location accounts for the fact that uncomplicated diverticula seldom give rise to symptoms. Because of the support they receive from surrounding tissues, including the peritoneum, the pancreas and the walls of the duodenum itself, they seldom sag and the neck seldom kinks unless they are quite large. Moreover, because the neck of the sac is usually wide, most diverticula empty readily.

*Etiology and Pathologic Anatomy.* The etiology of duodenal diverticula is not fully clarified. The acquired type, in contradistinction to the developmental or primary type, is usually located in the first portion of the duodenum. It involves all coats of the intestine, again in contradistinction to the developmental type, which usually involves only the mucosa or submucosa.

The majority of acquired diverticula are associated with duodenal ulceration. A smaller number are associated with disease of the gallbladder. One theory is that the shortening resulting from duodenal ulcer, which occurs just distal to the pylorus, produces redundancy of the lower border of the duodenum and favors the formation of a diverticulum. Another theory is that healing of the ulcer leaves a weak point in the wall of the duodenum.

Primary diverticula of the second and third portions of the duodenum occur on the same mechanical basis as all pulsion diverticula, that is, pressure from within against a weak area, presumably congenital, in the wall of a hollow viscus. As almost all diverticula of the second portion of the duodenum, as in the case reported herewith, project into the pancreas, it is possible that defective development of the longitudinal muscle of the intestine, as the result of a misplaced bit of pancreatic tissue, may be the cause of the weakness in the wall. Some diverticula exhibit pancreatic elements in their walls. It is also possible that the outpouching occurs at a point in the duodenal wall at which blood vessels make their entrance or exit.

Developmental diverticula are frequently multiple; it is quite possible that in the case reported herewith the smaller diverticula seen in the roentgenogram actually existed, though they were not sought for at operation because the larger diverticulum was evidently the cause of symptoms. Some duodenal diverticula are associated with diverticula of other portions of the intestine, as in one of the cases reported by Morton,[3] in which at least six jejunal diverticula were also present.

Certain other anatomic considerations are of surgical significance. Duodenal diverticula, as already noted, are frequently imbedded in the pancreas. Most diverticula of the second portion arise within a few centimeters of the papilla of Vater or are intimately associated with it. Finally, the superior pancreaticoduodenal artery or other vessels frequently run over the neck of the sac.

*Surgical therapy.* Indications for surgery in diverticulum of the duodenum were well outlined by Morton[3] under 3 headings:

1. Neoplastic change. Morton included Mendillo and Koufman's[4] case of sarcoma in his collected series but for some reason did not include Morrison and Feldman's[5] case of carcinoma, which was also treated surgically.

2. Inflammatory change. In this category are included such conditions as local diverticulitis, perforation, abscess and peritonitis, and secondary inflammation of the duodenum, biliary tract, pancreas, or retroperitoneal tissues. Morton's[3] collected series included 9 cases under this heading, of which one was an instance of gangrene and 4 were instances of perforation.

3. Stasis. There is, of course, no question of the need for surgery when a diverticulum is the site of neoplastic change or of progressive inflammation. Operation is necessary and may be life-saving. The indications are considerably less clearcut when diverticula are merely symptomatic. If the diverticulum is discovered merely accidentally, there is no indication whatsoever for surgery. If its presence is associated with symptoms, and if the symptoms are troublesome or incapacitating, and if they cannot otherwise be explained, operation is fully justified and the results are likely to be good.

The possibility of course, exists, as in the case reported herewith and in other reported cases, that symptoms may be due not to the diverticulum but to an associated lesion, which was corrected simultaneously with it. Most often, as in this case, the lesion is in the biliary tract. On the other hand, several cases are on record, including McQuay's,[1] Lucinian's,[6] and Hare and Cattell's,[7] in which an operation on the biliary tract for calculous cholecystitis was followed by recurrent symptoms which persisted until the duodenal diverticulum was removed. In Lucinian's case perforation of the diverticulum occurred after cholecystectomy had been performed.

An additional reason for not resorting to surgery in the absence of sound indications is that the removal of a diverticulum is frequently difficult. For this reason short-circuiting operations have sometimes been performed. They do not, however, seem a logical method of treatment for any case in which resection is feasible, and

the results are not uniformly good. Cases are on record in which it has been necessary to disconnect the gastroenterostomy and resect the diverticulum to give the patient relief.

Diverticula of the third and fourth portions of the duodenum present no particular technical problems. They are readily exposed by approaching the lesion by way of the lesser peritoneal sac. The approach to lesions of the second portion of the duodenum, where most diverticula are located, however, is frequently difficult because of their medial location, their involvement in the pancreatic substance, and their proximity to, or actual involvement in, the ampulla of Vater.

The most common method of approach to lesions of the second portion of the duodenum is to mobilize the duodenum mesially by cutting the peritoneal reflection laterally and rotating the bowel until the diverticulum appears. A particular advantage of this method is that this area of peritoneum is relatively bloodless. Another advantage is that the posterior wall of the duodenum may readily be exposed, if necessary, all the way to Treitz's ligament. In the occasional case it may be useful to follow MacLean's[2] suggestion and approach the diverticulum by way of the anterior surface of the duodenum. This method permits visualization of the relation of the lesion to the ampulla as well as inversion of the sac into the duodenum. Division of the pancreas, or separation of the pancreas from the duodenum, is an undesirable method of approach because of the likelihood of bleeding and the possibility of damage to the pancreatic tissues, with subsequent leakage.

Because of the hazards attending this particular kind of surgery, Pearse's[8] point is well taken, that descriptions of operations should not end with the approach of the lesion but with the removal of the sac. Possible dangers attending its removal are injury to the common bile duct, the pancreaticoduodenal vessels and the pancreatic ducts of Wirsung or Santorini, which may be damaged during the dissection of the diverticulum or during closure of the duodenum.

The method which Pearse proposed includes the following steps: 1. Mobilization of the duodenum to the left, so that, if necessary, it can be rotated to its embryologic position. 2. Exposure of the diverticulum by gentle traction combined with dissection, by which means the diverticulum is drawn out to the right of the duodenum. 3. Resection of the sac to within half an inch of the duodenal wall. 4. Inspection of the interior of the duodenum, if desired, to identify the opening of the ampulla of Vater. 5. Freeing of the neck of the sac, which can now safely be cut across. The line of excision is best placed about half an inch from the duodenal wall; the cuff of tissue

facilitates closure and also protects the ducts which may enter at the neck of the sac or at the junction of the sac and the duodenal wall. Probes can be placed in the pancreatic and the common bile ducts, and, if there is difficulty in identifying the ampulla of Vater, the common bile duct can be opened above and a catheter passed down into the duodenum. The probes and catheter are left in situ until the final sutures are placed to close the defect and a final inspection has made clear that no damage has been done.

In the case reported by Hare and Cattell[7] the patient, all of whose symptoms pointed to biliary tract disease, had been operated on three times before the diverticulum was discovered. Other cases are also on record in which the lesion was overlooked. The warning therefore seems necessary that, in operations for lesions of the right upper quadrant of the abdomen, diverticulum of the duodenum be borne in mind and be sought for, even if another apparently causative lesion is found. The reverse warning is also necessary; even if a diverticulum of the duodenum is identified, other possible lesions should be sought for.

Operations for diverticulum of the duodenum are attended with two possible postoperative complications other than those usually associated with operations for intraperitoneal lesions. One is duodenal fistula, the other is dissolution of tissue from leakage of pancreatic enzymes. The time to prevent both is, of course, at operation, when careful attention to the principles of modern surgical technic will usually avoid both.

### Report of Additional Case

A second patient with duodenal diverticulum who is likely to need surgery is at present under observation at the Vicksburg Clinic. He is a white male, 49 years of age, who for many years has had frequent attacks of sudden, sharp, burning epigastric pain, associated with abdominal distention, when he is in the recumbent position. Occasional attacks of vomiting seem unrelated to these symptoms. All laboratory studies were negative in this case except for roentgenologic examination of the gastrointestinal tract, which revealed a large diverticulum at the junction of the first and second portions of the duodenum and a probable smaller diverticulum in the descending portion. No cause other than the diverticulum has been found for the symptoms in this case and operation therefore seems indicated.

### Summary

An additional case of diverticulum treated surgically is added to the small number of surgical cases already on record in the literature. The lesion is not uncommon but seldom gives rise to symptoms and operation for it is therefore seldom indicated. Since surgery may be both difficult and dangerous, it should be resorted to only

on clearcut indications. Certain technical precautions which reduce the chance of damage to adjacent structures at operation are emphasized.

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# APPLICATION OF WAR EXPERIENCES TO CIVILIAN CHEST CASUALTIES

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THE recent war produced a number of advances in the treatment of chest injuries which may be applied to civilian casualties. One of the most important contributions of the military surgeon has been to shift the focus of attention from the pleural space to restoration of normal cardiorespiratory equilibrium by early reexpansion of the lung. Among the other advances produced by the war were: a better understanding of and more prevalent use of intratracheal anesthesia; more adequate preoperative preparation, advances in the treatment of hemothorax; decortication of the lung for clotted hemothorax or fibrothorax and empyema; a better understanding of blast injuries of the chest; and the demonstration of the feasibility of intracardiac surgery.

Space does not allow a detailed discussion of all these advances. This paper will be limited to the application of these advances in the treatment of traumatic hemothorax, fibrothorax, and empyema.

The war offered a good opportunity to test theories concerning hemothorax, as 70 per cent of the chest injuries admitted to General Hospitals in the United Kingdom Base Section suffered with hemothorax.[1]

It was formerly thought that most of the hemorrhage in hemothorax was from the lung and that removal of the accumulated blood would cause more bleeding. The replacement of the aspirated blood with air was advocated for the same reason.[2] We now know that persistent hemorrhage is usually from the intercostal vessels and that its presence serves no useful purpose.[3,4] Also, it acts as a good culture medium for bacteria and prevents reexpansion of the lung. The replacement of the aspirated blood by air has the same objections. Early in the war the importance of repeated aspirations of the chest to promote reexpansion of the lung was not fully appreciated. A number of chest cripples, most of them fortunately temporary, resulted from this.

The general principles that proved to be of benefit in the treatment of hemothorax were:

1. Restoration of the normal cardiorespiratory equilibrium and prevention of infection by early aspiration of the blood and air.

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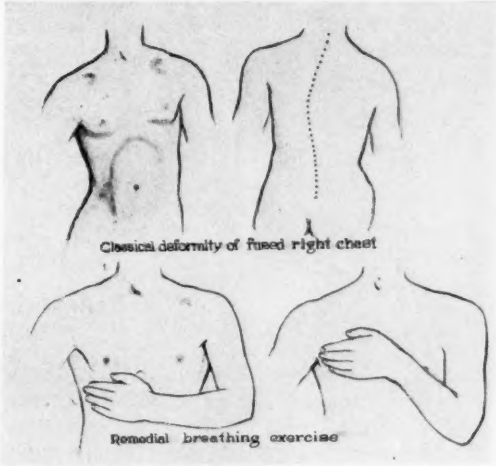
2. Prevention and treatment of shock by replacement of blood loss with whole blood.[5,6]
3. Local debridement of the wound, when present, to prevent infection and subsequent empyema.
4. Penicillin and sulfa compounds to aid in the control of infection.
5. Thoracotomy only if bleeding could not be controlled.
6. Corrective posture and breathing exercises to aid in reexpansion of the lung.




Figs. 1a and 1b

Though breathing exercises had been used previously, their value was not generally recognized until they could be evaluated in large numbers of chest injuries. When injured, the chest is voluntarily held rigid to decrease pain. The patient assumes a characteristic pose as shown in Figure 1a. He tilts his pelvis upward and pulls his shoulder down on the affected side.

In rehabilitation the patient is taught to sit straight in bed and to breathe deeply 10 to 12 times every hour. The hand from the opposite side is placed on the chest as shown (fig. 1b), and when the patient exhales he is told to press in on the affected side, and when he inhales to release the pressure. This will start the chest wall expanding with inspiration, and after even a few minutes of such exercise, some involuntary motion can be detected.

Some patients are at first confused as to when to apply the pressure to the chest wall. This may be corrected by having them whistle

when they exhale and apply pressure while whistling, or by having them exercise before a mirror. If there is pain on inspiration the effect of these exercises will be diminished, and the pain should be relieved by intercostal nerve block.

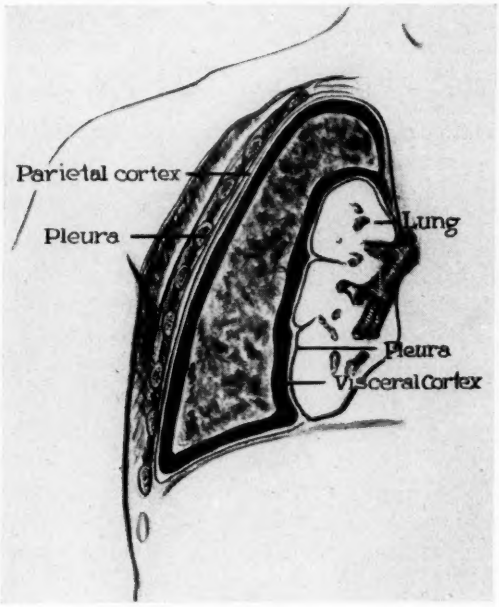



Fig. 2

Under this general outline of therapy most of the hemothoraces should show rapid improvement and usually will not require thoracotomy. If, however, blood is allowed to remain in the chest, infection and clotting may occur. When clotting occurs, the fibrin is deposited on the surface of the lung, diaphragm and parietal pleura (fig. 2). The clotted blood and loculated serum are shown between the fibrous layers. The fibrous membrane thus formed over the lung prevents its reexpansion and that over the diaphragm and chest wall prevents movement. This fibrous membrane has been called a cortex and when it requires surgical removal the operation has been called decortication. In general the operation is useful in long-standing cases of clotted hemothorax and empyema.[7] Small blood clots and cortices of less than 500 c.c. volume will usually be absorbed, but a large amount of clotted blood associated with a cortex after 4 to 6 weeks will persist for an indefinite time unless removed.

It is only necessary to remove the cortex from the lung and dia-

phragm. Removal from the parietal pleura will cause more bleeding and is not necessary.

The next 3 cases are presented to illustrate the usefulness of decortication in civilian chest casualties.

The first case is shown to illustrate the treatment of clotted and infected hemothorax.

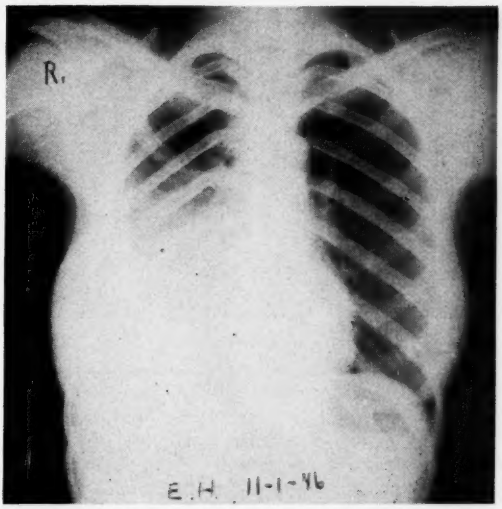



Fig. 3

The patient, a 24 year old colored female (E.H.—R-8928), was admitted Oct. 1, 1946, because of a stab wound in the second right interspace. X-ray examination on admission showed a small amount of fluid in the pleural cavity. Aspirations during the first 4 weeks of hospitalization kept the chest fairly dry and the lung expanded. However, after this time the blood clotted and repeated aspirations yielded only a few c.c.'s of turbid fluid. The temperature curve began to show high daily rises and the clotted blood was estimated by x-ray (fig. 3) to occupy about 50 per cent of the right chest. Thoracotomy with removal of the clotted blood and decortication was decided upon. Under cyclopropane endotracheal anesthesia, a section of the sixth rib was removed. A large amount of clotted blood was removed from the right chest and a soft fibrinous cortex was removed from the lung and diaphragm. A catheter was inserted in the seventh interspace and the wound was closed in layers.

The postoperative course was uneventful except for some difficulty with clotting in the drainage tube and failure of the patient to practice breathing exercises. The patient was discharged two and one-half weeks after operation. Although there was some cloudiness in the right chest at the time of discharge, the chest was clear at follow-up 3 weeks later (fig. 4).

The next case demonstrates the application of decortication to total empyema.

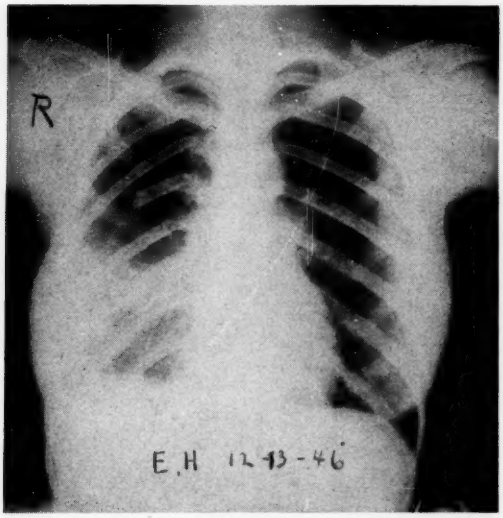



Fig. 4

The patient, a 24 year old colored male (L.B.—R-4718), was admitted May 30, 1946, because of a gunshot wound (.45 calibre) of the left side of the neck and the right chest. The bullet apparently passed through his neck without injury to any important structures. The right chest was perforated, however, causing a hemothorax which later developed into empyema. Early treatment consisted of thoracenteses and removal of the subcutaneous missile. About 6 weeks after admission, the lung was decorticated but later total empyema developed which necessitated rib resection drainage. Due to the infection another decortication would probably not have been successful at that time.

We first saw this patient about three and one-half months after his original injury. At that time he was having high fever, was draining 300 to 500 c.c. of foul pus from his chest daily, and the right lung was completely collapsed, being held down by a thick inflammatory cortex.

On a regime of improved drainage by irrigations and chest exercises for one month, the patient became afebrile and his general condition improved. However, as seen (fig. 5) the lung was expanding very slowly because of the thick inflammatory cortex. A large amount of protein was obviously being lost from the chest wound and it was impossible to keep the red blood cell count up to normal despite repeated transfusions. It was decided that although a decortication would be difficult in view of the thick inflammatory cortex, it would be worth trying. The prospect otherwise was long drainage and probably ultimately a thoracoplasty to close the dead space.

On October 3, five months after the original injury, an incision was made above the old chest wound and most of the sixth rib was removed. The lung was found to be almost completely collapsed against the mediastinum and the diaphragm was adherent to the lower lobe of the lung and pericardium by thick scar tissue. This was freed and the lung was separated from the medias-

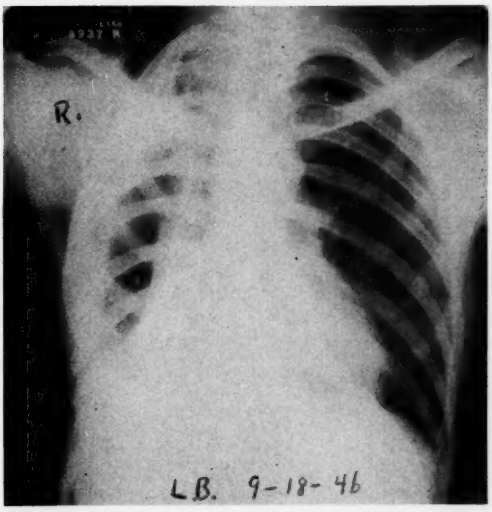



Fig. 5

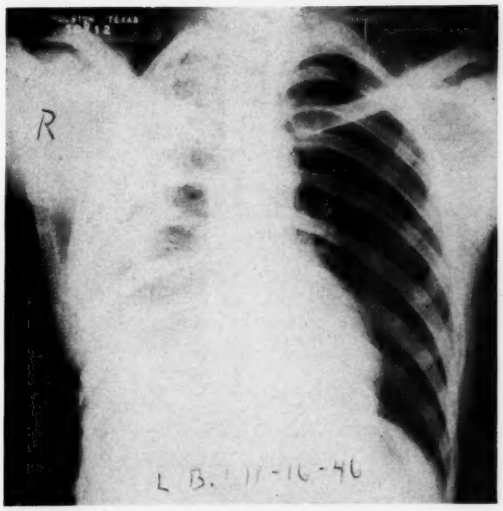



Fig. 6

tinal pleura in the manner described by Blades.[8] The thick cortex was very difficult to remove from the upper lobe and because the attempt at removal caused too many bronchopleural fistulæ, this procedure was abandoned and, instead, gridiron incisions were made. This allowed the upper lobe to expand about three fourths, but it did not quite reach the thick parietal cortex. The lower and middle lobes were easier to decorticate and their complete reexpan-

sion was accomplished. A plastic closure of the defect in the lower chest wall was done. An intercostal tube was inserted in the lower chest and the operative incision closed.

The postoperative period was somewhat difficult as was to be expected from the long-standing infection and debility. A tube was inserted into the second interspace to aid in expansion of the upper lobe and suction was applied to both intercostal tubes.

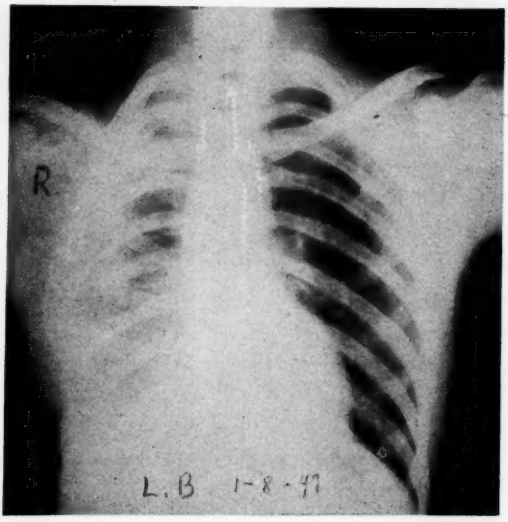



Fig. 7

At the time of discharge six weeks later the lower and middle lobes were completely expanded, as shown (fig. 6), and there was almost complete expansion of the upper lobe. The chest wound was closed except for a small superficial area about the size of a nickel where the skin had broken down. Thus in about 6 weeks the chest had been converted from an open, grossly infected cavity with complete collapse of the lung to a closed cavity with almost complete reexpansion of the lung.

Follow-up x-ray studies 7 weeks later (fig. 7), showed complete reexpansion of the lung, and the man returned to work doing manual labor 3 months after operation.

The next case demonstrates the application of decortication to empyema and the drainage of empyema pockets after decortication.

This patient, a 24 year old white male (F.T.—R-99871), had a strangulated diaphragmatic hernia of 11 days' duration at the time of operation.

On admission he showed severe shock, respiratory distress and a marked shift of the mediastinum to the right side. Aspiration of the chest yielded bloody, purulent fluid and the patient vomited a similar material. This patient presented a difficult diagnostic problem. Barium was introduced into the

Fig. 8

stomach and is seen (fig. 8) in the fundus of the stomach and above the diaphragm. This was a typical "upside-down stomach." The lines drawn on this film to represent the diaphragm are only approximate for purposes of demonstration. No barium is seen in the pylorus but some is seen in the fundus of the stomach. After the patient was received on the surgical service of Hermann Hospital, 36 hours was spent in preparing him for surgery. He was given massive transfusions and the chest was decompressed by catheter drainage.

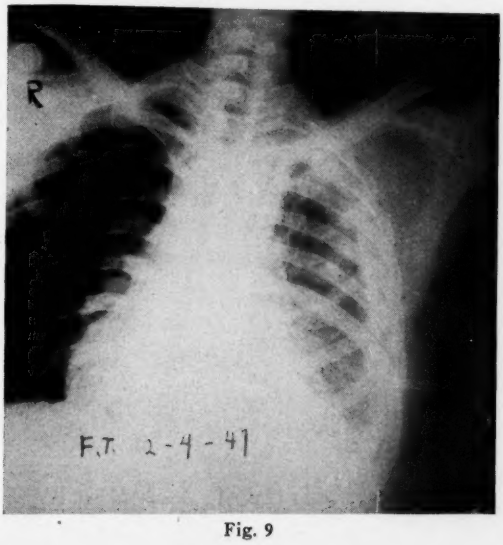



Fig. 9

A chest approach with removal of part of the eighth rib was chosen. On opening the chest a large amount of bloody pus mixed with barium was found. When this was removed the stomach and omentum could be seen in the chest cavity surrounded by a thick inflammatory exudate. The lung was plastered to the mediastinum by a cortex about one half inch thick. There was a large perforation in the stomach and its anterior wall was necrotic. The opening in the diaphragm, near its center, was enlarged and the entire stomach delivered into the left thorax for inspection. The posterior wall of the stomach was found to be intact, as it had not been included in the hernia. The necrotic

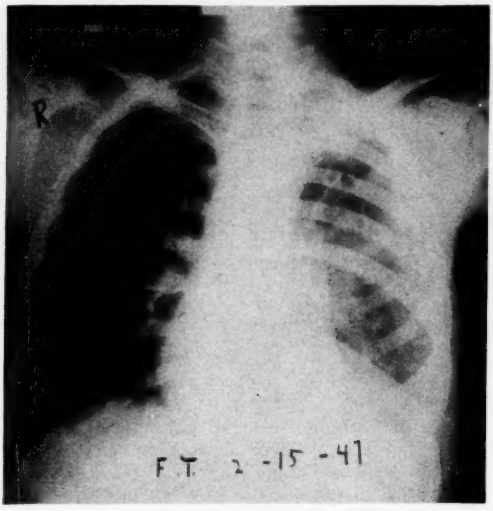



Fig. 10

anterior wall of the stomach was resected and the defect closed in a transverse manner. The Levine tube was passed into the lower portion beyond the anastomosis. The diaphragm was decorticated to produce more motility and was closed with a double row of cotton sutures. The lung was next decorticated, beginning with the upper lobe, and was fully reexpanded. Intercostal catheters were placed in the second anterior and the ninth posterior lateral interspaces and the chest closed.

Postoperative treatment consisted of application of the general principles as outlined for hemothorax and in addition five pounds of suction was applied to the catheters. The tubes were removed on the tenth day but two small pockets of empyema, which subsequently developed in other parts of the chest, required intercostal drainage. One of these empyema pockets is shown (fig. 9). Figure 10 shows the chest to be clear. However, several weeks later another pocket of empyema developed that required intercostal drainage.

## SUMMARY

In summary, some of the applications of war experiences to civilian chest surgery have been given. Emphasis has been placed on

some of the more common problems of chest injuries, traumatic hemothorax, fibrothorax, and empyema.

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# FAMILIAL SCIATICA DUE TO HERNIATED DISCS

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## INTRODUCTION

CLINICAL reports in the literature of sciatica occurring in several members of the same family, to the extent that operation is required for the removal of protruded discs, are rare. A careful survey of ten of the current textbooks of neurology and neurologic surgery reveals no such group of cases. The apparent rarity of such patients prompted the present report of a family (fig. 1 and fig. 2) in which the father and 5 of his 6 children had or have sciatica; in all, six operations for removal of protruded discs at the 4th or 5th lumbar interspaces or both have been necessary to date in this sciatica-inflicted family. The mother never had sciatica.

The father (as related by one of his sons) was bedfast for months at a time on several occasions with severe unilateral sciatica and has since died, at the age of 68, of another cause, the sciatica having *disappeared spontaneously* a year or more before death. He was never seen in our clinic. He was never operated upon for relief of his sciatica, as his disability antedated the modern treatment of sciatica by many years. He had had hip injections, the exact nature of which are unknown. He had 3 daughters and 3 sons. One of the daughters has a definite unilateral sciatica which varies in intensity and has not yet been operated upon (see below). One son is the only one of 6 siblings who has never yet had sciatica. Of the 4 remaining children, one son has had 3 operations in our clinic for unilateral sciatica (i.e., recurrent two times, always on the same side), another son has had a single operation for removal of a protruded disc and 2 daughters have each had a single disc operation, one in our clinic, the second, after study in our clinic, moved elsewhere and was operated upon in another city.

There was nothing remarkable about the etiology, clinical history or operative findings in these cases, except the *absence of any specific traumatic episode* in any of the patients. No congenital defects, such as a spina bifida occulta or lateral scoliosis of the lumbar spine, were detected on x-ray examination in any of the cases. Whether there was a congenital predisposition in the members of this family to sciatica or the formation of protruded discs is questionable, as no specific bony lesion or etiologic factor was common to all cases.

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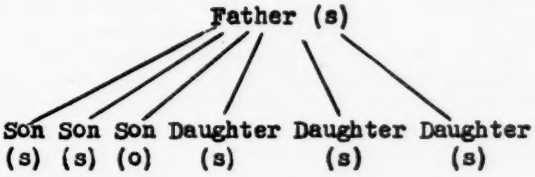
From the Department of Neurologic Surgery, Medical College of Virginia, Richmond. Read at the annual meeting of the American Academy of Neurological Surgery, Colorado Springs, Colorado, Oct. 11, 1947.




The symbol "(s)" after all but one of the patients signifies the ones who have or had sciatica (see text).

Fig. 1

DISC OPERATIONS IN ONE FAMILY
(All $L_4$ or $L_5$ Discs)

| | | |
|---|---|---|
| Father | severe sciatica | 0 |
| Son (A) | severe sciatica | 3 |
| Son (B) | severe sciatica | 1 |
| Son (C) | no sciatica | 0 |
| (only 1 of 6 siblings without sciatica) | | |
| Daughter (A) | severe sciatica | 1 |
| Daughter (B) | severe sciatica | 1 |
| Daughter (C) | sciatica not severe enough for operation (see text) | 0 |
| | Total number of operations to date | 6 |

Summary of family of father and 6 children, all but 1 of whom had sciatica in absence of traumatic history. Six operations have been required to date (see text).

Fig. 2

## CASE REPORTS

CASE 1 (Son): Three operations for right-sided sciatica, first, for removal of a protruded disc at the 4th lumbar interspace, second, for removal of a protruded disc at the 5th lumbar interspace, and third, for recurrence of disc protrusions at the 4th and 5th lumbar interspace. Therefore, actually, this patient had two separate sciatica attacks due, first, to a protrusion at the 4th lumbar interspace, and second, to a protrusion at the 5th interspace. His third attack was due to recurrence of the lesion at both interspaces.

M. S., a white male, aged 40, was first operated upon April 2, 1943, for a protruded disc at the right 4th lumbar interspace. There was no history of trauma. Two years before, he had had severe sciatica in the *left* leg which had since disappeared. Because of bilateral signs, a regular laminectomy was determined upon, with opening of the dura. A lipiodol injection in another hospital in the city 2 weeks before operation had shown an undoubted large lesion at the 4th lumbar interspace on the right side. The spines and laminae of $L_4$ and $L_5$ and the cephalic tip of the sacrum were removed bilaterally and the dura widely exposed. By gently palpating through the dura, a mass could be felt at the right 4th lumbar interspace. The dura was opened. There was no

intradural mass or tumor of the cauda equina. The dura was sutured and the dural sac deflected to the left. A large extradural mass was disclosed at the right 4th interspace, undoubtedly a herniated nucleus pulposus. It was removed after incising its capsule. It was fully as large as one's little finger and was excised in two large portions. No disc was seen at the 5th interspace. The microscopic examination of the removed tissue showed it to be typical nucleus pulposus material without evidence of neoplasm. The patient was discharged 9 days later to convalesce further at home and did well in the ensuing years, returning to his carpenter work.

*Second admission:* After a period of almost 4 years, he was readmitted on Feb. 10, 1947, with recurrent pain in the right leg of only 2 weeks' duration. While leaning over a sink he had developed a recurrence of his low back pain and peripheral right-sided sciatica, which was sudden and severe. Examination showed undoubted recurrence of a right-sided sciatica due to a 4th or 5th lumbar interspace protruded disc. Reoperation on February 14 disclosed under the $S_1$ root at $L_5$ interspace on the right side, a firm elastic protruding mass which was removed. The 4th interspace, the site of the disc first removed almost 4 years previously, was normal. While convalescing from the second operation, he developed symptoms of acute perforation of a gastric ulcer, which was repaired surgically and he made an uninterrupted convalescence from both operations. He was ultimately discharged from the hospital and returned to work.

*Third admission:* He was readmitted on June 20, approximately 4 months after his second disc operation, with a second recurrence of his sciatica, again in the right leg. At this time, leg traction was tried for a week without appreciable improvement, the pain remaining extremely severe with constant bed rest and leg traction. A third operation was undertaken on June 30. Definite recurrent discs were found at the 4th and 5th lumbar interspaces on the right side. At the 5th interspace a large single mass of cartilage 3 cm. in length and 1.5 cm. in width was removed; it was lying loosely under the 1st sacral nerve in the extradural space. A few of the posterior fibers of $S_1$ root were sectioned extradurally before closure. The patient made an uninterrupted convalescence and was discharged 2 weeks later, on July 14, and has since done well.

It should be emphasized that the involved interspace or interspaces were thoroughly curetted at each operation in this patient, and ***both the 4th and 5th interspaces*** were also carefully inspected at each of the three operations.

CASE 2 (Son): Single operation for removal of a protruded disc at the left 4th lumbar interspace.

C. S., aged 43, was admitted April 12, 1940. He had had pain in his lower back with intermittent radiation to the left leg for 16 years. Straining, coughing and sneezing exaggerated the pain. There was no history of trauma.

No sensory loss was detectable and the ankle jerks were equal and active in each leg. The clinical examination was rather equivocal so far as the presence of a herniated disc was concerned.

However, a lipiodol injection was done (spinal fluid protein, 85 mg.) which showed a constant filling defect (almost a complete block) at the 4th lumbar interspace. At operation (ether anesthesia), the 5th lumbar interspace was first inspected and found to be normal. At the 4th lumbar interspace on the left side, a large protruded disc was found and removed in one portion. The

patient made an uninterrupted convalescence and was discharged 13 days post-operatively in good condition.

*Follow-up:* When seen in the hospital six and one half years later (admitted at that time for congestive heart failure, from which he recovered), there was no evidence of sciatica.

CASE 3 (Daughter): Single operation for removal of a protruded disc at the right 5th lumbar interspace.

Mrs. I. H., aged 36, was admitted June 3, 1943, and gave a history of 6 years of low back pain without history of trauma. Six months before admission, the pain had begun to radiate down the right leg posteriorly and had become very severe in the ensuing months. For 2 weeks before admission, she was confined to bed because of the pain which was aggravated by walking, bending, coughing and sneezing and relieved by lying down. On examination, there was limitation of straight-leg-raising on the right side and hypesthesia of the right lateral foot. The right ankle jerk was absent. Naffziger's sign was positive. The right 5th lumbar interspace was very tender to thumb pressure, i.e., a marked and typical clinical picture of a protruded lumbar disc at the right 5th lumbar interspace. At operation (hemilaminectomy), a large disc was seen under the 1st sacral root on the right side at the 5th interspace and was removed extradurally without incident. Microscopic examination of the removed tissue showed it to be typical fibro-elastic cartilage. The patient made an uninterrupted convalescence and has since remained well, four and a half years after operation.

CASE 4 (Daughter): Single operation for removal of a protruded disc at the left 4th lumbar interspace—(operation elsewhere after study at the Medical College of Virginia Hospital).

Mrs. M. O., aged 33, was first examined on Feb. 8, 1945. She complained of pain in the lower back and left hip. There was no traumatic history. The pain was located chiefly in the left hip but the entire left leg "feels weak." She had been in bed 2 weeks before hospital admission because of severe pain in the lower back and left leg, posteriorly.

*Examination:* This suggested a left 4th lumbar interspace protruded disc. Lasegue's maneuver and straight-leg-raising induced pain in the left leg only. There was tenderness over the sciatic nerve in the left hip and leg and marked tenderness on thumb pressure to the left of the 4th lumbar interspace. A lipiodol injection showed no constant defects in the lower three lumbar interspaces. Plain x-ray films of the lower spine had shown narrowing of the 5th lumbar interspace. The patient was discharged from the hospital under conservative therapy. She then moved to a distant city, where the pain recurred even more severely than when examined by us. She was operated upon there in July, 1945, and a protruded disc at the left 4th lumbar interspace was removed.

Repeated efforts to obtain a follow-up report on, or examination of, this patient, who lives in a distant city, have been unsuccessful.*

*Unoperated Patient with Sciatica (Third Daughter):*

Mrs. H. H., aged 42, was examined in the office on Feb. 19, 1947. She

*Since this article was first submitted it has been learned that the patient is now free of pain following a second (fusion) operation.

had backache and pain in the right leg posteriorly extending into the ankle and foot. There was no traumatic history. This syndrome had been present for 20 years, first developing during her initial pregnancy. It was aggravated by walking and standing. She has not yet been operated upon but with the above-described syndrome, a protruded disc appears almost certain. She will probably be operated on in the near future.

## Discussion

The only unusual feature in this family of 7 individuals, 6 of whom have had or have sciatica, and on whom 6 operations for removal of protruded discs have been performed to date, is the fact that in all the histories it is specifically stated, after direct questioning of the patient, that *there was no traumatic episode* (direct or indirect). It is true that in some patients with protruded discs there is no history of trauma, but in 50 per cent or more of any large series of verified protruded disc cases, a specific traumatic episode is usually described. This lack of a traumatic element in the history of any of these 6 members of the same family who have or had sciatica suggests that a congenital etiologic factor is more important in the familial group of cases herein reported than in the average case of protruded disc. Bradford and Spurling,[1] in their excellent monograph entitled "The Intervertebral Disc," published in 1941, stated that it is evident that developmental anomalies may contribute to prolapse of the nucleus pulposus *into the adjacent vertebral body or bodies* (Schmorl's nodules). However, there are no reports—to their knowledge—to indicate that *posterolateral herniations* of the nucleus pulposus causing sciatica are due to *congenital defects* in the disc. The rarity of such lesions (protruded discs) before the third decade of life is in accord with this view.

All of the patients operated on in this series were in the fourth or fifth decade of life. Bradford and Spurling also stated that, since 75 per cent of the patients with disc herniations are in or beyond the fourth decade, it is apparent that *degenerative changes* in the disc which begin in the prime of life predispose to herniation of the nucleus pulposus; possibly such changes are the chief etiologic factor in the patients herein reported. Evidence is lacking to prove that congenital defects lead to this type of lesion, although they are probably a factor in prolapse of the nucleus pulposus into *the vertebral body.*

However, when one considers the multitude of embryologic changes taking place in the intervertebral disc from the time the primitive nucleus pulposus arises from the notochord, and the modification of the primitive nucleus pulposus by extension of tissues from the intervertebral disc anlage (Keyes and Compere—1932[2]),

it seems not unlikely that a congenital defect (questionably in the capsule) is present in some cases of lumbar protruded disc, especially in those patients in whom there has been no definite traumatic history, as in all 6 of the familial cases herein described.

It is theoretically possible, according to Bradford and Spurling, for the nucleus pulposus to herniate through a defect *at any point* in the annulus fibrosus. Several theoretical sources of defects in the embryologic cartilage plate which might predispose to prolapse of the nucleus pulposus can occur. It is possible that the point in the cartilage plate, through which the fetal notochord once passed, might remain weakened. If Schmorl's nodules can occur from *congenital* defects in the capsule, it seems reasonable to suppose that *congenital posterolateral defects* in the disc capsule, as well as superior and inferior defects, can be present, thus permitting sciatica to develop without particular trauma. Uebermuth[3] and Böhmig[4] have described 6 vessels entering the intervertebral disc which degenerate after adolescence. It is possible that these disintegrating vessels might constitute a source of weakness in the cartilage plate in the occasional case.*

## SUMMARY

1. A family of 7 individuals, consisting of a father and 6 children (3 sons and 3 daughters), all but one of whom had or have sciatica, is described. The mother never had sciatica but the father had a severe unilateral syndrome.
2. Six operations have been performed to date for removal of protruded discs in this family.
3. None of the 6 cases of sciatica had a history of traumatic episode (direct or indirect).
4. The possible etiologic factors (questionably congenital) in this unusual familial group of patients with sciatica are discussed.

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*Since this paper was written, a 23 year old white man has been operated upon (January, 1948) for removal of a large left-sided lumbar protruded disc at the 5th interspace. His father, aged 48, had been operated upon twice in an 8 months' period 5 years previously at another clinic for removal of left-sided lumbar protruded discs.

# TUMOR OF THE CAROTID BODY

## A Case Presentation

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BECAUSE carotid body tumors are so unusual the diagnosis seldom has been made preoperatively. Bevan and McCarthy[1] stated that only 14 such preoperative diagnoses had been recorded in over 113 cases reported up to 1929. Gratiot[2] presented an excellent review of carotid body tumors in 1943 and reported 2 cases of his own with the correct diagnosis having been made before operation in one of these. In 1941 Harrington, Clagett, and Dockerty[3] reported 19 patients with this tumor and stated that the correct diagnosis had been made preoperatively in only 3 instances.

The erroneous diagnosis made most commonly has been tuberculous cervical adenitis. This diagnosis appears most frequently in the older literature when it was not unusual to see scrofula. In recent reports one finds that a branchial cleft cyst has been the commonest incorrect preoperative diagnosis. This was true in one of Gratiot's, 6 of the Mayo Clinic series of 19, and in the case to be presented here. As the frequency of reports of this lesion increases, the percentage of correct preoperative diagnoses will become greater because of the higher level of suspicion in the surgeon's mind.

### CASE REPORT

The patient was a 60 year old, white, retired male.

PRESENT ILLNESS: About 3 years prior to hospital entry the patient had first noticed a lump in the left side of his neck. Aside from its presence it bothered him in no known way. About one year later he had begun to complain of intermittent headaches of moderate severity. These seemed related to nothing in particular. It was at the same time that he first noticed a slight deafness, especially of the left ear. His wife stated that beginning about 2 years before entry he had become irritable and very positive about any ideas or opinions which he held. He insisted on doing many things which seemed foolish and wasteful to the other members of his family. If he were "crossed" in any way he became very loud and unreasonable and as time went on he would have childish tantrums when opposed. About one year prior to entry he began making statements which seemed to be foolish and in other ways showing some tendency to disorientation. The headaches had been becoming more severe and more frequent during this interval. At no time had he had any symptoms referable to the throat, difficulty in swallowing, or any like trouble. He had never had any attacks of syncope, light-headedness, sense of smothering, cardiac disturbances, convulsions, et cetera.

The patient visited my office six months prior to his hospital admission for a brief consultation regarding the neck tumor only. At that time a diagnosis

of branchial cleft cyst was made and its removal advised. During the 6 month interval the tumor had increased in size by approximately one sixth.

FAMILY HISTORY: One brother (only sibling) died at the age of 38 from a cancer of the brain. There was no pathologic proof, but the history of the brother's case was excellent for this diagnosis. The father had been killed in a mine accident. The mother was living and well at the age of 81. There was no history of other known disease in the family.

PAST HISTORY: His mother had told him that he had had "brain fever" at the age of 4 years and that he was blind for a long time after this. The patient does not remember any details of this illness. He had had scarlet fever, typhoid fever, and spinal meningitis. No history of other disease. He had never had any serious injuries or any operations.

REVIEW BY SYSTEMS:

*Eyes:* Only the blindness mentioned above.

*Ears:* See present illness. No other disease.

*Nose and Mouth:* No known disease.

*Cardiorespiratory System:* Flu in 1917 which was complicated by extreme lethargy which he stated was called some kind of sleeping sickness. Never any pneumonia, hemoptysis, chronic cough, productive cough, night sweats, dependent edema, chest pain, dyspnea, orthopnea, etc.

*Gastrointestinal System:* He had never been a hearty eater. Whenever any new or seasonal food was introduced into diet he had a bout of diarrhea accompanied by occasional bloody and mucus-containing stools. There was some fatty food intolerance. Never any medical care required during these bouts. Otherwise there had been no history of rectal bleeding, melena, jaundice, hematemesis, nausea, vomiting, etc.

*Genitourinary System:* In recent years there had been some nocturia, slow starting, and dribbling. Never any hematuria, dysuria, enuresis, polyuria, frequency, urgency, etc. He denied venereal diseases by name and symptoms.

*Neuromuscular System:* He had never had any paralysis, numbness, girdle pains, paresthesias, nervous breakdowns, etc.

*Neuropsychiatric:* Since his brother's death (20 years previously) he had been a changed man. This statement made by his wife. He had been more than ordinarily attached to his brother. Since the latter's death the patient had been moody, unsettled, nervous, and easily dissatisfied.

MARITAL HISTORY: Happily married for 31 years. His wife, 2 children, and 3 grandchildren are all living and well.

WEIGHT LOSS: The patient had always been slender and there had been no significant recent loss.

Personal habits are good.

PHYSICAL EXAMINATION:

*General Appearance:* The patient was well developed, fairly well nourished, and appeared to be in good health.

*Head:* Normal scalp.

*Eyes:* Pupils were equal and regular and reacted well to light and accommo-

dation. Extraoccular movements and fields of vision were grossly normal. There was no elevation of the optic discs.

*Nose:* Normal.

*Mouth:* Edentulous. The mucous membranes of the mouth and oral pharynx were normal. The tongue was normal and protruded in the midline.

*Ears:* Slight hearing loss on the left. Not accurately measured.

*Neck:* No palpable lymph nodes. The thyroid gland was not enlarged. In the midportion of the neck on the left and just below the anterior border of the sternocleidomastoid muscle there was a large, firm, movable, nontender mass. It felt quite deep and measured approximately 6 cm. in diameter. The mass was spherical in outline and was palpated within the mouth as well as externally. It did not protrude into the pharynx at any point. It was movable in all directions, although vertical movement was more restricted than lateral motion. There was a fluctuant feeling to the mass. There was no visible nor palpable pulsation, either transmitted or intrinsic. No sinus opening or dimple could be seen in the skin.

*Chest:* Symmetrical in shape and movement.

*Lungs:* Clear to percussion and auscultation.

*Heart:* There was no percussible enlargement. There were no murmurs. The sounds were of good quality and the rhythm was regular. Blood pressure: 120/80.

*Abdomen:* Normal. No organs were definitely palpable.

*Genitalia:* Normal male.

*Hernia:* There was a large indirect type inguinal hernia present on the right. None on the left.

*Rectal:* Normal anal canal. There was a moderate enlargement of the prostate gland but no hardness. The gland was symmetrical.

*Extremities:* Normal.

*Reflexes:* Equal and active throughout.

CLINICAL LABORATORY:

The blood and urine examinations were within normal limits. The blood Kahn test was negative. An x-ray examination of the chest was normal.

PREOPERATIVE PREPARATION:

The patient had been found to be in excellent general condition. No specific preoperative preparation was indicated.

PREOPERATIVE MEDICATION:

Morphine sulphate, gr. 1/4, and atropine sulphate, gr. 1/150, were given hypodermically one hour before surgery.

PREOPERATIVE DIAGNOSIS:

Branchial cleft cyst.

POSTOPERATIVE DIAGNOSIS:

Carotid body tumor.

OPERATION:

The neck was widely prepared and draped after the method for thyroidectomy. A sandbag had been placed under the lower part of the neck, and the head was turned slightly to the right. An incision was made which started over the anterior border of the sternocleidomastoid muscle 2 cm. below the mastoid process. It was continued down along the anterior border of that muscle to a point approximately even with the prominence of the thyroid cartilage. A few enlarged lymph nodes were found in the subcutaneous fat and in the fat just below the external cervical fascia. One of these was taken for examination. The mass in the neck was exposed without difficulty. The external maxillary artery and the anterior facial vein were severed and ligated. The mass was found to lie in the crotch formed by the branching of the common carotid artery and it measured approximately 6 cm. in diameter. It was a dusky red color and seemed solid. It was attached to all the surrounding structures by fairly firm adhesions. The dissection of the mass from these adhesions was made difficult by the profuse bleeding which occurred each time the mass itself was damaged at all. The anterior two thirds of the mass was exposed with moderate difficulty and the carotid branches could be seen coursing over the surface of the posterior third of the tumor. The internal carotid artery lay over the lateral surface of the neoplasm and was compressed to such an extent that it was flat in contour. It had been turned abruptly lateralward at the carotid bifurcation and thereby its course had been the more altered of the two branches. The external carotid artery lay over the medial surface of the tumor and was less compressed than its partner vessel. The remaining attached portion of the mass was dissected free from its attachments with extreme caution. Bleeding had been noted from a point approximately 2 cm. cephaled from the bifurcation and on the anterior surface of the internal carotid artery. This had been controlled previously with a fibrin foam pack and pressure. During the last part of the dissection this point again began to bleed although no dissection was being carried out in the immediate area. The bleeding was coming from a small tear in the adventitia of the vessel immediately below which could be seen intact media. The tear of the wall was oblique and I presume that it was occasioned by the previous dissection in the presence of arteriosclerotic plaques in the vessel wall. Suture of the wall was required to stop the hemorrhage. The remainder of the tumor was then dissected free from the arteries. I felt that there was no tumor tissue remaining at the close of the dissection. It was my opinion that the tumor was satisfactorily freed from the vessel surfaces without any neoplastic tissue being left in or attached to the vessel walls. At no point did the attachment of the tumor to the vessels seem to be solid. Most of the dissection between these structures was carried out bluntly. At the close of this procedure the operative field was dry. The incision was then closed in layers using 00 plain catgut in the subcutaneous layers and interrupted silk in the skin.

During the course of the dissection the tumor mass grew progressively smaller. It measured 3 cm. in diameter at the close of the operation. This loss in mass was accounted for by the tumor's having angiomatous characteristics. At the close of the operation no pulsations of the internal carotid artery could be felt. The vessel appeared to be thrombosed.

ANESTHESIA:

Because a less extensive procedure than was carried out had been originally planned, a local infiltration of one per cent novocaine was used for anesthesia.

When it became obvious that the procedure was to require a considerable length of time, an inhalation of nitrous oxide, oxygen, and ether was started. One liter of whole blood and one liter of normal saline were administered intravenously during the operation. The patient's course during anesthesia was uneventful.

SURGICAL PATHOLOGY REPORT:

*Gross:* The specimen is an encapsulated rubbery globoid mass of tissue about 2.5 cm. in diameter. The cut surface is salmon red with a grayish tracery traversing the surface.

*Microscopic:* Sections reveal connective tissue septae of variable thickness dividing off areas composed of masses of cells. These masses vary in size. The cells are polyhedral and contain an abundance of cytoplasm. The nuclei show variation in size and shape. There are numerous variable sized vascular channels. The connective tissue septae contain aggregates of lymphoid tissue. The lymph node present shows the changes of hyperplasia.

FINAL DIAGNOSIS:

Carotid body tumor.

POSTOPERATIVE COURSE:

Three hours following surgery the patient was seen to move his left extremities only. At this time he had recovered only partially from his anesthesia. Painful stimuli to the right extremities evoked prompt protective movements, but of the left extremities only. Five hours later he elevated his right knee, actively. The patient recovered the use of his right side to a moderate degree on the first postoperative day and was able to sit on the side of the bed without aid. His speech was incoherent but he seemed to understand everything said to him. By the third postoperative day he had recovered almost full use and a remarkable degree of strength on the right side and was found out of bed adjusting his bedside stand that evening. One half of the skin sutures were removed in the fourth postoperative day and the remainder on the fifth day. The wound healed per primum without complications. Nine days following surgery the only signs of the hemiplegia were a slight right facial weakness (central type) and still some apparent mental confusion. There was a slight hoarseness present. The patient's temperature rose to 100.0° F. the third postoperative day and returned to normal that evening. He had no other fever.

CONDITION ON DISCHARGE:

The patient left the hospital on the seventeenth postoperative day in excellent condition. An attempt to visualize the vocal cords on that day was unsuccessful.

FOLLOW-UP:

*One month* following the operation the patient's mental condition had improved considerably. His wife stated that he was nearly as well in this regard as he had been prior to operation. An examination of the vocal cords demonstrated a complete paralysis of the left cord; however, this hoarseness was hardly noticeable. All signs of the hemiplegia had disappeared except for a very slight facial weakness.

*Two months* following surgery one was able to notice no defects resulting from the operation. His headaches were less frequent and less severe. There was no audible voice abnormality, and visual examination of the cords showed some motion of the previously paralyzed left cord. There was no facial weakness.

*Six months* later the patient had changed none. He was in good health and had no complaints referable to the surgical procedure. The left vocal cord had continued to improve.

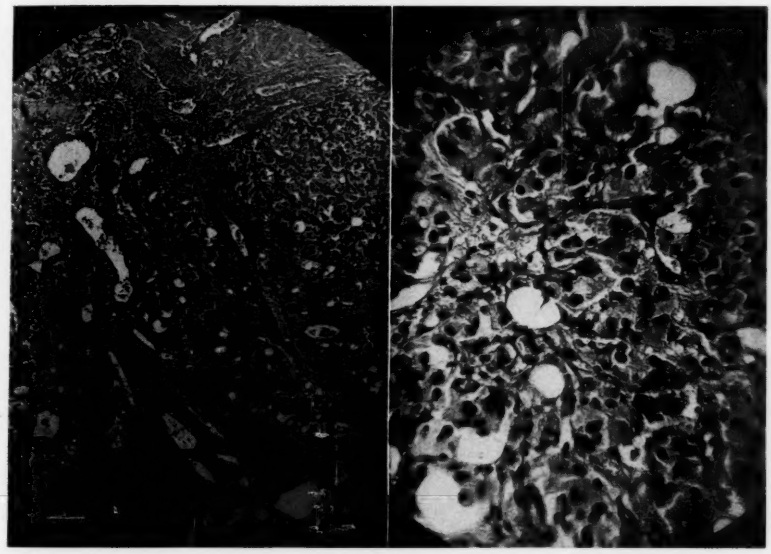

Fig. 1-a Fig. 1-b

**Fig. 1-a. Low power photomicrograph showing masses of cells separated by thick, *vascular* bands of connective tissue which shows some hyaline change. This appearance places the tumor in the peritheliomatous pattern of Dockerty. 1-b. Higher magnification to show the characteristic pale polyhedral cells in the "alveolar" portion of the tumor.**

## Diagnosis

One should be tempted to make the diagnosis of a carotid body tumor in the presence of a mass in the neck if the following criteria are met:

Any fairly regular tumor which underlies the sternocleidomastoid muscle in its midportion and which is: a) firm, b) non tender, c) pulsile but not expansile, d) slow-growing, e) compressible, f) fairly easily movable in the horizontal plane but limited in vertical movement.

Special notice should be paid to the last requirement. Many of the lists of diagnostic criteria which have been published state that

the carotid body tumor will not move in the vertical plane (in the plane of the long axis of the carotid vessels). I feel that this is an erroneous statement carried from one generation to the next. In the present case the tumor was definitely movable in the vertical plane even though this movement was very limited as compared with the lateral or horizontal movement.

The differential diagnosis in cases of lateral cervical tumors covers a large field of pathology. Such conditions as dermoid, branchial cleft cysts, cystic hygroma, aneurysm, various lymph node changes, metastatic and primary neoplasms, et cetera, must be considered. For a review of these entities and their comparisons with the carotid body tumor, the reader is referred to the short list of references found at the conclusion of this paper.

## Symptoms

The carotid body tumor is usually an unilateral growth and rarely causes any symptoms except that of a "lump" in the neck which has slowly and continuously increased in size. It is the cosmetic defect which usually brings the patient to his physician. Several cases with definite symptoms referable to the tumor have been recorded. Most of these symptoms consist merely of a sensation of tingling or burning in the immediate vicinity of the mass or a choking sensation when the head is in a certain position. Occasionally symptoms such as hoarseness, dyspnea, dysphagia, tinnitus, carotid sinus syndrome, Horner's syndrome, local pain, et cetera, have occurred from pressure on surrounding structures such as the vagus nerve, branches of the brachial plexus, cervical sympathetics, the laryngeal nerve, the trachea, esophagus, and so forth. These instances are unusual in carotid body tumors. In my case the patient presented a history of definite recent cerebral changes which at first the family had not connected with the presence of the tumor. I have been unable to find any other mention of this finding as a symptom caused by the presence of the tumor. The patient was elderly and most likely the cerebral circulation was strained to the utmost prior to the growth of the tumor. The tumor mass had occluded the internal carotid artery, and undoubtedly this loss of blood supply accounted for the signs of mental deterioration which the patient exhibited. The transient hemiplegia which occurred following the operation demonstrated that the internal carotid artery previously had not been occluded completely, but that its lumen had been narrowed partially. Although this partial occlusion caused the patient's most important symptoms, it also prepared the brain for the final complete loss of its left-sided arterial supply and was probably respon-

sible for the briefness of the hemiplegia and the patient's recovery from the operation.

## Anatomy, Histology, Physiology, and Embryology

The anatomy, histology, physiology, and embryology of carotid body tumors have been discussed repeatedly by previous authors. Little else but confusion and argument has been added by each succeeding, reiterative discussion. A paper showing considerable original thought and investigation was written by Balfour and Wildner in 1914.[4] The other papers listed in the table of references contain excellent reviews of these phases of the study of carotid body tumors.

Briefly one can say that the carotid body is a bilateral, minute, inconstant structure richly endowed with sympathetic and cranial nerve fibers and an abundant blood supply. It is located in the crotch of the bifurcation of the common carotid artery and is attached firmly thereto. The embryology and physiology of the organ are not definitely understood. One doubts if any specific function exists. The only known pathologic entity is the carotid body tumor, referred to by a host of synonyms. This tumor, for the most part, imitates the normal histology of the body with an hyperplasia of all elements. It could be used as an excellent example in the definition of an hamartoma. An especially valuable and complete review of the pathology of this tumor may be read in the article published by Harrington, Clagett, and Dockerty.[3]

In most reports mention is made of the vascularity of the tumor, and in several instances cited, surgery had to be stopped because of the profuse hemorrhage. I feel that not enough emphasis has been placed on this feature of the carotid body tumor. In many of the published photomicrographs and in my own case, one can notice the unusual vascularity of the tumor which approaches that of an hemangioma (fig. 3). Harrington, Clagett, and Dockerty advocated the compression of the common carotid artery to note decrease in the size of the tumor as an aid in diagnosis. Prolonged, gentle, firm compression of the mass itself will result in a temporary diminution of the size of the carotid body tumor. There will be a rather rapid return to normal size when the compression is released. I know of no other cervical tumor mass which will respond to pressure in this same manner.

## Treatment

It is generally agreed that surgery is the only rational method of treatment for the carotid body tumor. It has been suggested that all such tumors are malignant and that invasion of the wall of the

carotid is present in all cases. The latter fact, therefore, requiring excision of the carotid bifurcation universally. I cannot agree that so radical a procedure need be carried out in those patients where excision of the mass alone is possible. As Bevan and McCarthy[1] pointed out, ligation of the common carotid artery is accompanied by a high mortality rate. Unless the malignant character of the tumor can be proved, I feel that the procedure carries too great a risk and offers too little relief from actual danger to the patient.

## Comment and Summary

1. A brief review of carotid body tumors has been presented.
2. An additional case has been recorded in detail.
3. Attention has been called to the vascularity of these tumors, a change which sometimes approaches an hemangioma in character.
4. Symptoms of headache and signs of cerebral degeneration have been recorded as probably caused by compression on the internal carotid artery by the enlarging tumor mass.
5. Compressibility, with temporary retainment of the smaller size, has been mentioned as a diagnostic aid.

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# EARLY CARCINOMA OF THE PROSTATE

## Its Diagnosis and Treatment

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IN the current campaign to lower the mortality produced by cancer, carcinoma of the prostate has not been emphasized in a manner consistent with its frequent occurrence. In 292 consecutive autopsies in males over 50 years of age, Rich[1] found microscopic evidence of carcinoma in 41, or 14 per cent. The number of these lesions which were recognized clinically was 27 or 35 per cent. Moore[2] published, in the same year, similar results of studies made independently. He found 73.5 per cent of the lesions to be confined to the posterior lamella.

The record for early clinical detection of the small lesion is not satisfactory. Colston,[3] in 1943, reported that only 20 per cent of 358 cases of prostatic cancer were seen early enough to complete surgical removal of the malignant growth. Yet, this is a lesion which begins to grow in the posterior portion of the gland, within reach of the examiner's finger in the rectum. Since a lesion confined to this region may not yet be in a position to produce symptoms, the early diagnosis must frequently be made by rectal examination alone. The physician must discover the disease without the usual clue of urinary complaints. This means, in short, routine rectal examination of every male patient over 50 years of age. Any area of induration in the prostate must be identified as cancerous or noncancerous.

*Diagnosis:* The most significant finding on palpation of the carcinomatous prostate is induration. This is best described as "stony hard." Its presence in the gland of a man over 50 years of age should suggest carcinoma until proved otherwise. If the differential diagnosis includes chronic prostatitis, there are several characteristics of this disease which may be helpful. The induration of prostatitis is usually less marked. It is often symmetrically localized over each lateral lobe or its outer border, leaving a sulcus of soft tissue in the midline. Gentle pressure will often eliminate this type of induration. However, it must be remembered that firm pressure in the presence of carcinoma carries the risk of dissipating the malignant cells beyond the fascial limits of the gland. Pus in the prostatic secretion does not rule out the possibility of carcinoma, since the presence of the former may be unrelated to the induration.

Tuberculous prostatitis may be manifested by induration almost

as marked as that of carcinoma. This is often localized bilaterally, leaving a central area which feels quite normal. Tuberculous prostatitis is a disease of younger men; but it may persist in the older age groups. In some cases the gland is nodular. The x-ray film may show irregular areas of calcification, a strong differential point in favor of tuberculosis.

Prostatic calculi may also produce induration. They are easily demonstrated by roentgen examination.

There are certain cases which defy definite diagnosis without operation. In these, biopsy by frozen section is necessary. The greatest accuracy will be obtained by surgical exposure of the gland for this purpose, rather than by aspiration through the perineal skin. The opportunity to prove conclusively the identity of suspicious lesions is one of the principal advantages of perineal prostatic surgery. Microscopic examination of tissue removed accurately from the area of induration will usually confirm the diagnosis. The experienced pathologist will be able to recognize carcinoma in the frozen section in most cases. It is of value to both pathologist and surgeon to practice routine biopsy of the prostate at the time of each radical prostatectomy. In this way reliable judgment in doubtful cases is attained. If the report is negative for carcinoma, the surgeon is faced with the decision of whether or not to excise the entire prostate and seminal vesicles. If an experienced urologist has diagnosed carcinoma positively on rectal examination, considerable importance is attached to this finding, especially if the tissue for biopsy may not have contained the suspicious area. Figure 1 shows a rectal chart in which a localized nodule has been felt on rectal examination. By use of these charts for the description of rectal findings, the area for biopsy can be identified exactly at the operating table.

Figure 2 represents carcinoma beyond the limit of complete removal, since the seminal vesicles have been invaded. It is fortunate that involvement of the periprostatic tissues is a late manifestation of the disease.[2] Thus, there is an especially good opportunity to detect the cancer early and to remove it completely, if the gland alone is indurated. The heavy fascial investment of the prostate prevents early invasion of the structures adjacent to it.

*Treatment:* The work of Huggins[4] is now widely known and accepted. This observer showed that growth of carcinoma of the prostate recedes markedly when the effect of testicular hormones is either removed by castration or counteracted by ingestion of diethylstilbestrol. In advanced carcinoma, the gland decreases in size and induration temporarily. Huggins[5] stated in 1946 that although the

effects of orchiectomy (observed after a period of 5 years) are at times very profound and prolonged, it is premature to suggest that any one of these patients has been cured. In his report, only 5 of 20 patients were alive at the end of 5 years. Thorough postmortem studies have thus far proved that these patients die of prostatic carcinoma, or show residual cancer following fatal intercurrent disease. For these reasons, orchiectomy and transurethral resection of obstructing prostatic tissue have usually been reserved for advanced, not early, carcinoma.

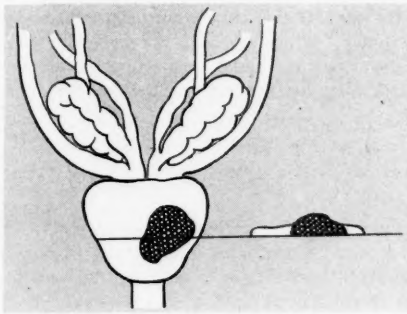

Fig. 1. Chart of rectal findings showing localized nodule of early carcinoma of prostate. Suitable for radical prostatectomy.

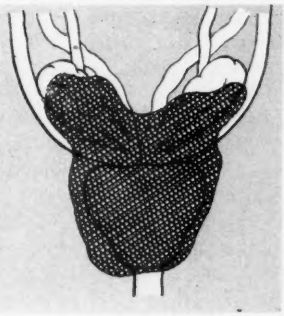

Fig. 2. Chart of rectal findings showing advanced carcinoma of prostate involving seminal vesicles and periprostatic tissues. Unsuitable for radical prostatectomy.

The only way in which prostatic carcinoma can at present be eradicated is by its early surgical removal. Young[6] analyzed a series of 61 cases treated by radical prostatectomy. Survival was obtained for more than 5 years in 53 per cent. One patient was living and well after 22 years, 1 after 12, 1 after 11, 1 after 10, 1 after 9, 1 after 8, 1 after 6½, making a total of 7 after 5 years. Nine patients died without evidence of carcinoma, 5 years after leaving the hospital, and 1 in less than 5 years, of another disease. The operation was successful in leaving 17 patients without evidence of prostatic carcinoma.

In the ideal case for radical prostatectomy, the general health should be good and the life expectancy 5 years or more. The latter stipulation is made since a few patients have been known to survive for 5 years when treated by orchiectomy or diethylstilbestrol.[5]

The technic of radical prostatectomy has been perfected by Young[6] and others, until it can be recommended with the reservations mentioned above. When properly performed, elimination of malignant disease is frequently possible. Following operation, a

period of training is necessary before urinary leakage is controlled. A possible explanation of this is that, following removal of the vesical neck and prostate, the full impetus of bladder contraction is borne by the annular portion of the external urinary sphincter. This imbalance adjusts itself; so that the patient ultimately learns to control the urinary flow between voidings. Colby[7] has reported postoperative urinary continence in 80 per cent of his cases.

A brief summary of a typical case follows:

G. H., 69 years of age, was a single white male admitted May 13, 1941, to the hospital because of difficulty with urination. Two months previously he had noticed urinary frequency, hesitancy, dribbling, and nocturia 15 to 20 times each night. These symptoms gradually increased until complete urinary retention occurred. The patient stated that his general health had been good until the present illness.

Physical examination revealed considerable hardening of the peripheral blood vessels. The blood pressure was 220/105 millimeters of mercury. There was no evidence of cardiac embarrassment.

On rectal palpation by two examiners, the prostate was moderately enlarged and nodular. The induration was stony hard only in the region of the prostate. There was slight induration at the base of the seminal vesicles; but the gland could be moved. The membranous urethra was soft.

Laboratory studies showed the non-protein nitrogen to be 25 mg. per cent. Although the excretion of phenolsulphonphthalein was poor at the time of admission, the total excretion was 65 per cent in 2 hours, after 15 days of continuous vesical drainage by catheter. A plain roentgenogram of the abdomen showed no evidence of metastases.

On May 28 the writer carried out radical perineal prostatectomy, according to the technic described by Young.[6] The specimen removed consisted of the prostate, seminal vesicles, and margins of membranous urethra and vesical neck. The microscopic diagnosis was carcinoma of the prostate. The postoperative cause was relatively smooth. Because of urinary leakage, it was necessary to reinsert the catheter, which had been first removed 19 days after operation. One week after this was done, the catheter was again removed. The patient was instructed to start and stop the urinary stream while voiding. He later was able to hold his water satisfactorily both day and night.

On March 16, 1948, 5 years after operation, rectal examination showed no evidence of metastasis. Urinary control was perfect.

## Summary

1. The high incidence (14 per cent) of prostatic carcinoma in males over 50 years of age, and the necessity for routine rectal examination in these patients, are stressed.

2. The results of radical perineal prostatectomy for early carcinoma (5 year survival in 53 per cent) and of palliative therapy including orchiectomy (5 year survival in 25 per cent) for advanced carcinoma, are discussed.

3. A typical case, reexamined 5 years after radical prostatectomy, is presented.

34 Seventh Street.

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# CYSTS OF THE FALCIFORM LIGAMENT

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Cysts of the falciform ligament of the liver are comparatively rare. A superficial review of the literature reveals very few references to them as such. Therefore it seems worthwhile briefly to review the subject.

Etiologically these cysts have been classified as primary and secondary. Primary cysts are of lymphatic origin, or from peritoneal inclusions, or from a developmental defect. I am inclined to believe, at least in the case presented herewith, that the cyst is a true mesenteric cyst; that is, in the development of the peritoneum there has been an inclusion of a cystic pocket between the leaves of the peritoneum forming the falciform ligament. Cysts of secondary origin include echinococcus cysts, and those following hematomas, and cystic degeneration of some metastatic tumor.

The pathology of all cases has been essentially the same. There is a thin fibrous connective tissue wall with a thin smooth endothelial lining. The wall may contain a few muscle fibers. The cysts are usually unilocular and contain serous fluid which is clear or slightly milky or straw-colored. The fluid contains albumin and may show a few leukocytes or red cells. The size may vary considerably, from a few centimeters in diameter to the size of an infant's head.

The differential diagnosis is not usually made until the time of operation. The mass which is nearly always palpable may be confused with tumors of the liver or kidney. An amebic abscess or echinococcus cyst may be suspected, and here the history together with laboratory and antigenic tests may help to rule out these conditions. Dermoids, hematomas, hypernephromas, tumors of the omentum, and mesenteric cysts in other locations must also be considered. X-ray studies may be of value in ruling out connections with the kidneys and with the gastrointestinal tract, and in suggesting a mesenteric cyst. The tumor mass is usually palpable and usually lies to the right of, but not below, the umbilicus. It is mobile and may be moved laterally but has little excursion perpendicularly.

The symptoms will vary with the individual case. There is usually a mass noticed, and this may be the only complaint. There may be pain present in the right flank or lumbar area, or in the epigastrium.

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The opinions or assertions contained in this article are the private ones of the writer and are not to be construed as official or reflecting the views of the Navy Department or the naval service at large.—J. S. Brown, Jr.

At times there is indigestion and flatulence, and a full feeling which is more marked after meals. The pain may vary from a dull dragging ache to a colicky type pain which is more severe in certain positions.

The treatment is surgical excision. All cysts reported have been completely removed without difficulty.

The case incidence is low. In 1937 Herrou[1] wrote a rather complete treatise on the subject and reviewed the French literature. He found only 2 cases previously reported, and he added a third. These cases briefly were:

1. Male, aged 32. Pain in the right flank for 2 years with indigestion and a full feeling, and a mobile tumor mass to the right of the umbilicus. This was thought to be a mesenteric cyst of the mesocolon. Operation revealed a unilocular cyst of the size of an infant's head and located between the leaves of the falciform ligament.

2. In 1926 Chifoliau[2] reported a case—male, aged 49; mass in the right upper quadrant, movable, not tender, and of the size of an ostrich egg; present for 3 or 4 years. No other symptoms. It was thought to be a hydatid or mesenteric cyst. Operation revealed a unilocular cyst between the folds of the falciform ligament, 7 or 8 cm. long, and containing clear fluid. The endothelial lining was thought to indicate a peritoneal origin and that it was probably an inclusion product during development.

3. Herrou's case[1] was a female, aged 31. She had complained of pain in the right lumbar area for 8 years. A barium enema showed pressure from a tumor which was thought to originate from the right kidney. At operation a multilocular serous cyst the size of an infant's head was found in the free portion of the falciform ligament with pedicles to the liver and to the umbilicus.

In the English literature Wakely[3] reported a case in 1931—female, aged 59, with the complaint of indigestion for many years and a lump in the epigastrium for 4 months. Operation revealed a cyst of the size of a golf ball located at the hepatic end of the falciform ligament.

In the American literature Toland[4] reviewed the literature on cysts of the liver other than hydatid cysts, and made no mention of cysts of the falciform ligament. In 1909 Henderson[5] reported a case in a male, aged 41; the cyst was the size of a child's head, contained straw-colored fluid, and had its origin in the lower 2 inches of the round ligament of the liver where the ligament is closely attached to the abdominal wall.

The case I have to report follows:

On Jan. 4, 1947, Captain E. K. G., aged 26, white male, was admitted to this hospital, with the chief complaint of pain in the upper abdomen. On the previous evening he had noted a gnawing pain in the pit of his stomach, and had reported to the Dispensary. Examination was reported to be negative, and he felt better after drinking a glass of milk.

He slept very well until 3:30 a.m., at which time he got up to go duck shooting. He still had a slight soreness in the epigastrium, but felt very well. About 9:30 a.m. he suddenly developed a severe sharp pain across the upper abdomen. The pain was aggravated by any movement, and he felt better doubled over. There was no nausea or vomiting. The pain had persisted and remained about the same until reaching the hospital at 6:30 p.m. There had been no previous gastrointestinal symptoms of any sort, nor had there been any change in the size of the abdomen.

Past history revealed no serious illness, accidents, or operations. He was an only child, and his parents were living.

Physical examination revealed a young officer in acute distress. He was sitting bent over with his knees drawn up. His temperature was 100.2° F., pulse 110, and respiration 22. The examination was negative except for the abdomen which was flat and not distended. There was general marked rigidity which was board-like over the upper portion. Palpation was generally painful but more so in the epigastrium and both upper quadrants. The rigidity precluded satisfactory palpation but there was suspicion of a mass in the left upper quadrant below the costal margin. Peristaltic sounds were somewhat diminished.

The blood study revealed a normal red cell count and 12,600 white cells, with 84 segmented cells and 16 lymphocytes in the differential count. The urinalysis was normal. X-ray (flat plate of the abdomen) showed no air beneath the diaphragm and no evidence of intestinal obstruction; however, there was an area of hazy density overlying the midline to the left kidney region, suggesting a mass at the level of the left kidney of unknown origin.

A definite diagnosis was not made although a tumor of the omentum or a mesenteric cyst was considered likely when he was examined under anesthesia. He was taken to the operating room after preparation, and a spinal anesthetic of 18 mg. of pontocaine was administered. This relieved his pain and relaxed his abdomen so that a definite smooth mass could be felt over the region of the spleen. This mass could be displaced to the right to the gallbladder area. A right paramedian incision was made, exposing a cyst about the size of a grapefruit (10 by 12 cm.) in the free portion of the falciform ligament (see diagram) with a further sausage-shaped extension about 8 cm. long in the parietes to the base of the umbilicus. At the junction of the parieto-ligamentous area there appeared to be a partial clockwise torsion of the free part of the cyst giving the appearance of a fibrous band about the neck of the sausage-shaped portion. The round ligament fibers seemed to thin out over the left wall and dome of the cyst. The cyst was carefully dissected out in its entirety. It contained a thin clear amber-colored fluid with a few small free grains or lumps of what appeared to be fibrin. Chemical analysis revealed these to be cholesterol.

The pathologic sections showed the cyst wall to be composed of thin fibrous tissue with a few small collections of smooth muscle fibers and lined with a single layer of normal appearing endothelial cells.

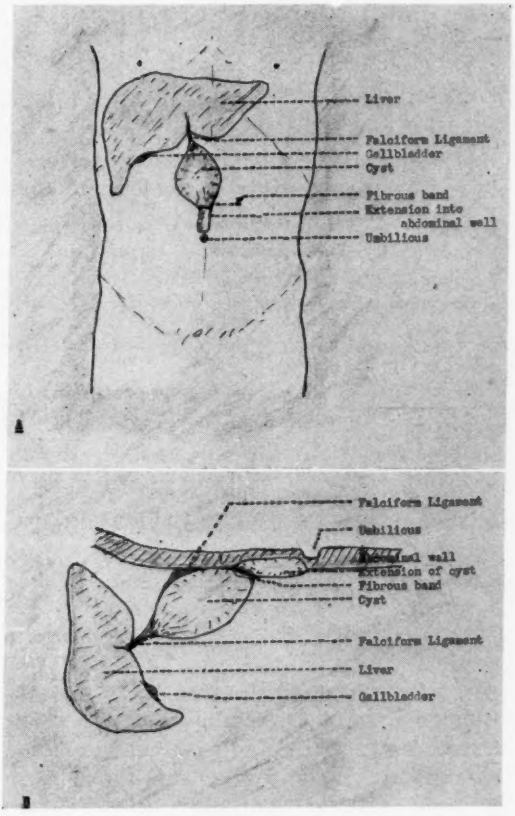


Fig. 1. Schematic diagram to show (A) anterior appearance of cyst and (B) lateral view.

The patient made a good postoperative recovery and was allowed to be out of bed on the first day after operation. His temperature did not rise above 100° F., and was normal after the second day. The skin sutures were removed on the seventh day, and the incision healed firmly. He was permitted to go on leave on the twelfth day after operation, and was returned to duty on the twenty eighth day. At present, seven months later, he has had no return of any symptoms.

## Comment

Falciform ligament cysts are of academic interest but, because of their rarity, are of no great practical importance. It is a condition to bear in mind in the diagnostic problem of an upper abdominal mass. The case described above is unusual in the sudden onset of symptoms, and in the evidence of a partial torsion of the cyst to account for the acute distress of the patient.

## Summary

1. A brief review of the subject of cysts of the falciform ligament of the liver has been presented.
2. An additional case report has been made.
3. The case described was different from any previously reported in the acute onset of symptoms with evidence of torsion of the cyst.


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## OPERABILITY OF THYROID CASES

The operability of thyroid cases is a complex matter and can be determined only after proper consideration of a number of factors. The final decision must be made by the surgeon himself, who alone is familiar with what the operation entails, and can not be delegated to an internist or based upon any laboratory test. The operation should be so decided upon and performed as to result in a smooth convalescence and to avoid in particular injury to the recurrent laryngeal nerves, injury to or removal of the parathyroid bodies, and inadequate removal of the thyroid gland. The generally accepted optimum mortality is about one half of 1 per cent. To make it consistently lower would necessitate refusing to operate in bad risk cases, some of whom could be saved. To keep the morbidity and mortality at a low level requires constant vigilance.

First, it must be clearly understood that thyroidectomy must never be undertaken as an emergency measure for the relief of hyperthyroidism, as the operation temporarily aggravates the disease process, and may induce a so-called crisis. The same applies in the case of pressure symptoms except in the presence of marked and progressive tracheal obstruction, where operative relief is urgent.


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Thus, in most cases, there is ample time for observation and adequate preoperative preparation.

Acute diffuse thyroiditis will likely subside upon systemic treatment. Abscess of the thyroid gland will require incision and drainage or partial excision, in which case there is no urgency unless there is an accompanying tracheal obstruction.

The condition of the heart is the most important single factor. Compensation must be present, and where there is only limited cardiac reserve, the operation must be limited in extent. A pulse rate below 100 is desirable, but a rapid pulse rate is not incompatible with a safe risk. Whether slow or rapid it is important that the rate be stable. In auricular fibrillation the heart should be well digitalized. In case of anasarca, a long period of preparation is necessary in order to get rid of all of the edema. Most deaths occur on a cardiac basis. Control of the hyperthyroidism by iodine and thiourates usually gives time for building up the cardiac reserve.

The hyperthyroidism must be subsiding and in a state of partial remission. In this respect the general clinical picture is the best guide, although at times basal metabolic determinations are of great assistance. In many instances the hyperthyroidism subsides and the basal metabolic rate reaches a normal level before the case constitutes a good operative risk on account of remaining anasarca, a poor cardiac reserve, a poor state of nutrition, or an intercurrent disease. On the other hand, a persistently high metabolic rate does not necessarily indicate a bad operative risk, provided that in other respects the condition of the patient is satisfactory.

The patient should be taking nourishment well and preferably gaining weight. Diarrhea and nausea contraindicate operation. Associated diabetes must be under control. In such cases the caloric intake should take into account the increased basal metabolic rate and must be adequate to permit a gain in weight, even though this requires giving more insulin than that necessary to keep the urine sugar free.

The nervousness, restlessness, and apprehension are in proportion to the activity of the hyperthyroidism, and must be reduced to reasonable limits. The morale of the patient is of utmost importance, especially in poor risks, and where the operation is to be performed under local anesthesia. An uncooperative and uncontrollable state of mind adds to the technical difficulty and to the operative risk.

The use of thiouracil or its derivatives in preparation of the patient causes a hyperplasia and vascularity which add greatly to the difficulty of proper performance of the operation. This is obvi-

ated by discontinuing the thiouracil after its effect has been obtained, and giving iodine for the two or three weeks immediately before operation. When using thiourates one must be on guard against untoward reactions, in particular, leukopenia.

The presence of tracheal or bronchial obstruction adds to the difficulty of the operation, and accordingly to the associated risk. Unless the obstruction is of such degree as to necessitate an emergency operation, a period of bed rest will almost invariably result in a decrease of the obstruction with corresponding improvement in the condition of the patient.

It may be necessary to limit the extent of the operation in the aged on account of their poor physical reserve, and in the very young on account of their reacting more severely; likewise in the presence of intercurrent disease when the general condition of the patient is poor. The decision may be made before or during operation. While the use of thiourates and iodine preoperatively has made possible subtotal thyroidectomy in most instances, there still remain some cases in which a staged operation is preferable. The removal of a single lobe is a procedure of proportionately much less magnitude than the removal of both lobes, and it is correspondingly better tolerated by the patient. The improvement following the removal of one lobe is temporarily comparable to that following the complete operation, so that the removal of the remaining lobe at a later stage is attended by minimal risk and morbidity.

The occurrence of a vocal cord paralysis is always of great concern. If more than transient, it greatly complicates the postoperative course—a bilateral vocal cord paralysis is a tragedy, often requiring a tracheotomy. The occurrence of a vocal cord paralysis during the removal of the first lobe in a bad risk patient is an indication not to remove the second lobe at the time. In the average good risk case, the second lobe should be removed using more than usual care to avoid injury to the other recurrent nerve.

Always to be considered, in determining the operability of a particular case, are the technical difficulties anticipated, the ability and experience of the surgeon in this field, and the operating and anesthetizing facilities at hand.

With proper attention paid to the operability of these cases, the morbidity and mortality can be kept to a low minimum and the results made almost invariably most satisfactory.

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## COMPLEX SIMPLE FRACTURE

*To the Editor:*—Realizing that the term "simple fracture" as generally defined is thoroughly inadequate to describe the trauma received in many so-called simple fractures, I have added a new definition to the simple and compound fracture nomenclature, i. e., "complex simple fracture" (Key, J. A., and Conwell, H. E.; The Management of Fractures, Dislocations and Sprains, ed. 4, St. Louis, C. V. Mosby Company, 1946, pp. 41-43).

A complex simple fracture is a fracture which is not compound but which has received severe trauma to either or all of the surrounding soft structures, i. e., skin, muscles, blood vessels and nerves. The bony fragments usually are displaced to a marked degree.

"Complex," as defined by "Webster's New International Dictionary," unabridged, is as follows: (1) an assemblage of related things; (2) a whole made up of complicated or interrelated parts.

The complex simple fracture should be further described as to the type of bony injury, for example: complex simple fracture (transverse, comminuted, spiral or oblique, as the case may be).

Through personal contacts and correspondence with the personnel of the three National Fracture Committees (American Medical Association, American College of Surgeons and American Academy of Orthopaedic Surgeons) with reference to their opinions and the necessity for such new fracture term or definition, there was unanimous agreement that such a definition of complex simple fracture was a necessary one and should be generally accepted and used in its broad meaning.

I make an appeal that this new fracture definition or its relative equivalent be used by the members of the medical profession. Besides expressing more adequately the pathologic process in such type fracture it will mean improved records for the hospitals and convey a better description of the fracture to the insurance companies, compensation boards and other related agencies, thereby being of much help to the patient, the physician and every one concerned.

I will appreciate any opinion or suggestions relative to the foregoing.

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